THE FOUNDRY

VOL. 12. DETROIT, MICH., JUNE, 1898. No. 70.

Straightening Crooked Castings.

BY R. H. PALMER.

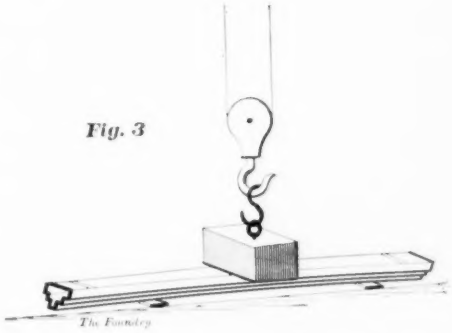
I think some of my brother foremen have, in all probability, had some of the above work to do owing to improper molding or perhaps to the shape of the casting required.

I hardly think there is a foreman who, on receiving a long, narrow pattern, does not think of one of the first points to look out for, namely, is that casting going to be crooked? Will it not, owing to its length and shape, warp out of true in cooling?

Fig. 1

Fig. 2

Fig. 3



Many are the devices tried, and a great deal of thought given to what the outcome is to be. How many times will we see a number of molders talking together about a pattern given one of their number and hear on approaching one of them say: "The boss (or old man) says do so and so and keep it straight;" and then the reasoning and arguments brought forward about what has happened when a pattern something like it was molded before. Each one may think of some different way to obtain the desired result.

I remember a gentleman for whom I was making castings in a jobbing foundry coming to me evidently very much provoked, and saying: "Mr. Palmer, I know you telephoned me about that pan pattern (6 ft. long by 1 ft. 2 in. wide, and of which the sides were some 2 in. high and beveled as shown in Fig. 1) asking me about cutting it and fixing it, but here I sent you a new pattern finished up in good shape, and I get that pattern back with sides sawed in three places down to the bottom, and pattern sprung on a former some three-eighths inch out of line; I can't understand what it means." I asked him if the castings he got were not straight. He said they were; he had no fault to find with the castings, they were all right. It was the pattern being spoiled; and on learning the pattern was sprung and molded in that way to allow it to crook straight (as the molders sometimes call it), he was dumbfounded, but soon saw the point.

The foremen of jobbing shops often have castings to make from patterns that have been made by a carpenter who knew nothing about pattern making, but was told by his employer to make something in a certain shape, and who honestly believed he had made a first-class pattern. Had he heard some of the compliments paid him when it was being molded it would have opened his eyes.

Especially is the above true of building work. Going into a foundry a few days ago I saw a man making a column from a pattern well finished, but it was costing to mold $1.85 per column, where I have had the same molded for $1.50, for the reason my pattern was made to mold, the other by a man who neither knew how to or what parts to halve of the pattern to mold to advantage, let alone the right amount of draft.

He made it as he wanted it to look after it was made, yet that builder could see no reason why he should alter the pattern or pay for altering, and he was even striving to obtain his castings a little cheaper—a lit-

tle give and take on both sides; a little explanation and trying to understand and helping each other and both would be money ahead.

Again in building work but few patterns are made straight. If molded straight pilasters have an unpleasant way of coming up on the ends to look you in the face, and if they do there's a nice job to straighten; and let me say here, I think the temperature of the iron when pouring has a great deal to do with a casting's crooking. In a number of cases where a lot of castings were to be made I found some castings some 10 feet long crooked all the way from three-quarters of an inch down to three-eighths of an inch, the casting varying so. I found in looking into the matter that some which were poured rather too slow, or with the temperature of the iron pretty well down, would crook more than those poured hotter, so by watching a little I soon found those poured about so hot and molded three-eighths of an inch crooked came straight.

The above castings (see Fig. 2) were finished on top side. Those that came crooked I took to the forge and heated them red hot in the center, or where I wished to bend them, and when I had them as hot as I thought advisable I placed them under a crane and gently lowered a weight of some 1,500 pounds on them. One point I wish to call particular attention to is the degree of heat the casting is to be heated to.

If you get the casting too hot it becomes rotten and loses its strength; or it may be burned and sometimes even melted by putting on too much blast, if using a forge. I should have said I raised the casting from the floor on bearing, as shown in Fig. 3.

Again, do not get the bearings too far apart, if they are the casting will spring in its length and you will find there is quite a difference in the result of springing and bending; in one case the casting will nearly return to former curve, while on the other hand if you have the bearings the right distance apart and the casting to a red heat or a little above, and bend the casting a trifle more than enough to straighten it, as it will come back a little, you will find the casting straight when cool. I think my experience has been that of a number of others in trying to straighten a casting that the important part was to get it hot enough; it is seldom you find a man always successful in this work, but after watching and studying to get the proper degree of heat (and one must go by color and action of fire) I have made few failures.

Another casting, and one that took some time, was a frame, that in molding the molder forgot to use a level or straight edge. Imagine a frame consisting of an upright rising from a half circular base, some five feet high, with an arm running from right of upright, starting eight inches above circular base, continuing some ten inches and then turning a sharp angle up in line with first upright, thereby forming a jaw for a box containing the end of a roll to travel in, two being used to a machine. The molder let the point of one jaw drop below the other, which brought a wind in the casting which was too much to plane out, being about five-sixteenths of an inch down; the casting at the arm running to right which I wished to twist, thus bringing the point that was down, up, so the two ends of uprights would be the same height from planer table, to plane aright, was 6 inches by 4½ inches thick. I placed bearings under the circular base (turning the casting on its side), put bearings under the point where the arm started from the upright, also where it turned up to form the second upright to make the jaw, leaving as much space between the two bearings as possible for fire, also under point of first upright.

This had to be done under a crane as I was not situated so I could heat the casting and bring it to the crane, it weighing about 1,200 pounds; but having a lot of old gas pipe some 2½ inches in diameter I led a line from the little forge (hand forge originally), a distance of some 23 feet, to the casting, used blacksmith's coal and coke laid on a tuyere gotten up for the occasion and started the fire, and heated the 6x 4½ inches of solid iron so hot that by taking a weight of 2,000 pounds and lowering it on the point of the upright which I placed up, I forced that point down where it belonged on a level with the other, and on cooling off it was found all right, and finished satisfactorily. Remember when it was down far enough I used iron blocking so it could go no farther.

I have seen a number of times a man take a casting and heat it and pile on the pig iron and provide no bearing in the cen-

ter for the casting to stop at when it had gone down far enough, and so it would keep going until he said it was crooked more the other way, and because he had nothing to stop it and it had gone so far below the straight line he thought it could not come back, but on cooling off the casting would have the same old crook, for it would come back to its original crook. Whereas had he provided the center bearing for it to stop at and heated it red hot it would have stayed there.

The main point in straightening castings is to get the casting to be operated on hot enough if fire is used for straightening.

What is Semi-Steel?

While cast iron mixtures may be greatly improved by varying the different metalloids to suit the special requirements of any particular casting, it is nevertheless a fact that most of the so-called "secret" mixtures rely largely upon the ignorance of the foundrymen for their success. Mr. A. E. Outerbridge, Jr., in a recent contribution to "The Digest of Physical Tests," asks the question, "What is Semi-Steel?" and gives vent to many truthful expressions not calculated to be pleasing to the promoters of patent processes. We have condensed the following from his article:

Astonishing claims are now being made for a new metal called "Semi-Steel," and in order to call forth a prompt correction, in case of error, I propose to make here the assertion that there is no such metal as semi-steel, and furthermore, that the material so-called is not a new discovery.

The name semi-steel is, in my judgment, a misnomer and an altogether misleading term. It is, I admit, sometimes difficult to define the line of demarkation between steel and malleable iron, since one blends almost insensibly into the other, but chemical analysis of so-called semi-steel fails to show any closer relationship whatever between this metal and steel, while physical tests are also equally widely divergent.

The following table represents fairly well the extreme variations in composition of each of these three forms of iron, viz., pig iron, steel and malleable iron:

Chemical Elements.	Pig Iron Per Cent.	Steel. Per Cent.	Malleable Per Cent.
Iron	90. —95.	98.5—99.5	99.5—99.9
Carbon	2.5 — 4.	1.5— 0.5	0.5— 0.1
Silicon	0.2 — 3.5	Trace.	Trace.
Sulphur	0.01— 0.5	Trace.	Trace.
Phosphorus	0.01— 1.5	Trace.	Trace.
Manganese	0.1 — 2.	0.01—2.	Trace.

N. B.—Special steels may, of course, contain much more manganese, others may contain nickel, etc., and traces vary.

The following composition may be taken as a fair average analysis representative of a good, strong No. 2 foundry iron:

Graphite Carbon	3.81 per cent.
Combined Carbon	0.19 per cent.
Silicon	2.00 per cent.
Phosphorous	0.416 per cent.
Sulphur	0.013 per cent.
Manganese	0.355 per cent.

When steel scrap is melted with pig iron in a cupola the effect is, of course, to increase the proportion of iron and decrease the other elements in direct ratio to the amount of steel added. Assuming that it is practicable to melt in a cupola 50 per cent of steel with 50 per cent of pig iron to make "semi-steel," a very simple calculation will show that the resultant metal still comes within the chemical classification of cast iron.

The diluting—if the expression may be permitted—of all of the elements, other than iron, has not been sufficient to bring the metal within, or even approximately near to the chemical classification of steel. Furthermore, lowering the proportion of silicon to one-half of the original content has the effect of causing nearly all of the carbon to remain chemically combined with the iron when quickly solidified, leaving a small proportion only of uncombined or graphitic carbon; this greatly increases the chilling property of the metal, and causes it to become white or mottled in light castings. In order to prevent this occurrence it is customary to add a certain percentage of silicon, usually in the form of high silicon pig iron, in the cupola; this prevents, in a measure, the overturn of carbon from graphite to combined carbon, and keeps the metal gray; but it still further widens the breach chemically and physically between steel and this metal improperly called semi-steel.

The simple fact is that the melting of steel with pig iron causes the steel to lose its identity completely, but the pig iron does not thus lose its characteristic qualities, and the resultant metal is simply a strong, close grain cast iron, which has neither chemical nor physical relation nor resemblance to

steel, and, therefore, the popular term "semi-steel"—which some manufacturers have adopted with eclat—is misleading.

With regard to the novelty of the discovery, it can be shown that the process is more than fifty years old, and was practiced in England long ago.

Sixteen years ago, while in charge of the metallurgical department of a car-wheel establishment which operated under the "steeled wheel" patents of William G. Hamilton and George Whitney (a process of melting steel scrap with pig iron to increase the chilling property of the metal), a distinguished engineer, Sir Frederick Bramwell, formerly in charge of the metallurgical and gun-making department of the Woolwich Arsenal, England, visited the works. He was particularly interested in the car-wheel metal mixture of steel and pig iron, and said that it was similar to a process with which he was familiar in his youth called "Stirling's toughened cast iron" and on his return home he sent me the specification of Stirling's patent granted in 1846, from which the following paragraphs have been taken:

"For certain purposes, such as shaftings, cranks for steam engines, girders or beams, guns or ordnance, and where a metal possessing greater tenacity or strength than ordinary cast iron is required, and where it is an object to vary the degree of hardness, I make a mixture of wrought iron and cast iron. * * * I would remark that cold blast iron, or iron containing the lesser quantity of carbon, will require a smaller addition of wrought iron than hot blast iron, or iron containing a larger quantity of carbon; but I find the addition of from about one-third to one-fifth of wrought iron to answer well in the generality of cases where increased strength, toughness, and tenacity are required. The above compound may also be made of iron from the puddling furnace after it has been treated, so as to get rid of the scoria, but a larger proportion of such iron will be required. These mixtures of cast and wrought iron may be conveniently called 'toughened cast iron.'"

Wrought iron and steel are so nearly alike in composition that they may be considered as identical for the practical purpose of melting with pig iron, the advantage, if any, resting with wrought iron, as that is a purer metal than steel.

The term which Stirling applies to his metal is not "semi-wrought iron" nor "semi-steel," but "toughened cast iron"—a perfectly correct designation.

It is claimed that castings made of semi-steel have extraordinary strength. Published tests show as high, I believe, as 40,000 pounds tensile strength per square inch, or possibly more. Does this really represent the strength of a casting, or simply the strength of a comparatively small test-piece?

Cast iron differs radically from cast steel not only in its composition and its physical properties, but in the fact that it is subject to great modification of its properties according to the rate of cooling of the mass. A large and a small casting poured from a ladle of steel will not greatly differ in the quality of the metal. If the metal is high chilling iron, a small casting may be perfectly white, hard as flint and brittle as glass. A large casting from the same ladle may be perfectly gray, tough and ductile. A medium sized casting may have a "lively" gray color, a close crystalline fracture, and higher tensile strength, with comparatively little ductility or resilience. The rate of cooling is such an important factor in determining the quality of cast iron that it is entitled to be regarded as a characteristic function of the metal.

More or less vague claims are made for the beneficial effect of adding to semi-steel small doses of various "medicines," usually in the shape of coarsely ground or crushed alloys into the ladles of molten metal, but it is not difficult for the chemist or metallurgist to ascertain what alloys of metals, or chemicals, are suitable and available for treating cast iron in the ladle or in the cupola; and while I believe that such treatment may be, and often is, beneficial, I am exceedingly skeptical regarding many claims that have been put forward in recent years, with the accompaniment of elaborate tables that give an air of scientific accuracy or acumen to such disquisitions, but are sometimes found on closer scrutiny to be full of contradiction and absurdity. While I do not desire herein to criticise any particular writer or article, I think it is time to call a halt upon hasty compilations of half-digested experiments of amateurish investigators, which are put forward often through the medium of proceedings of technical societies of high standard. More care-

ful examination of such papers before acceptance would avoid the dissemination of erroneous statements, or the necessity of withdrawing them after they have appeared in print.

With respect to the claims for so-called semi-steel, I reiterate my statement made at the beginning of this paper, that there is no such metal, and that the metal so called is by no means new to metallurgists. I do this, as already stated, for the purpose of inviting contradiction to my statement of facts, and not to disparage the work of any individual.

I am a seeker of knowledge, and wish to be assured of the correctness of that little which I have gained in a long course of years, or else apprised of my errors. * * * Tests made at the Watertown Arsenal of two bars of Major McDowell's "cupola steel" cast 1½ inches round, turned to 1.129 in., showed tensile strength 42,820 lbs., and 46,400 lbs. per square in. Two bars cast 1 in. square, turned to .564 in., showed 45,840 lbs. and 49,200 lbs. tensile strength per square inch. It will be noticed that the smaller bars were the stronger. The bars used by the Major to determine the "machinability" of the metal were 4-in. diameter.

Had the tensile test bars been cast of this size, or larger, and turned down to 1.129 in., I believe that the strength per square inch would have been far less, for the published analysis of the metal indicates that it is strong cast iron, subject to the law of cooling of that metal, which I have endeavored to enunciate in this and other papers upon the subject."

Molding a Tea Kettle.

By J. R. DOUGLAS.

Although the molding of hollow ware of all kinds has become a specialty, yet the well informed man finds that much of the practice found in special shops may at times be turned to advantage under widely varying circumstances.

Figure 1 shows the mold board with the bottom half of the pattern placed thereon and the molder in the act of placing the cope. In molding tea kettles, the cope is rammed up first together with the sprue and after turning over, the pattern is half filled with sand, this part of the core, which forms the inside of the tea kettle, being generally simply rammed with the hands, a molder's hands being his best tools. After ramming up the lower half of the pattern, the top half is placed in position and the spout tucked up solid (see Figure 2), when some parting sand is put on the joint and the nowel is ready to be rammed up as in Figure 3. The nowel should be rammed up level with the cover hole when we are ready to place the anchor (see Figure 3) in the pattern and fasten the cross-bar into the dovetails in the nowel, taking care that the key (see Figure 3) which holds the an-

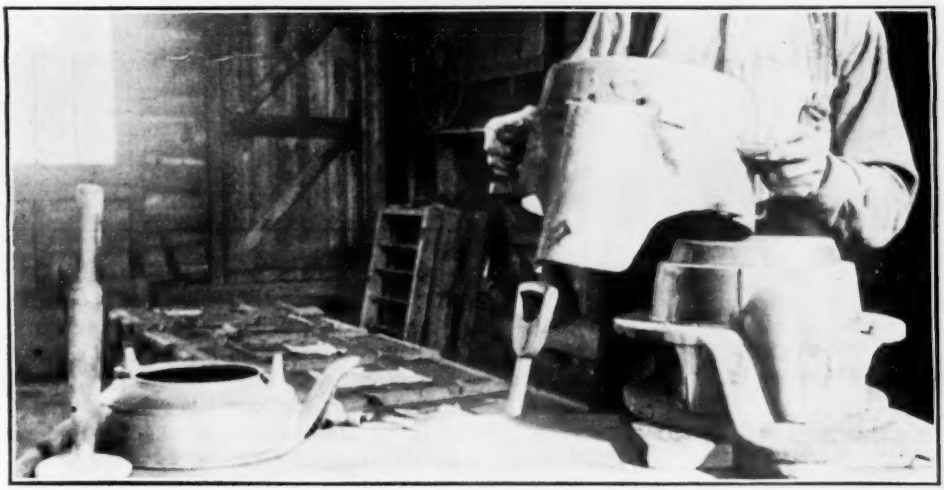


FIG. 1—MOLDING A TEA KETTLE.

chor to the cross-bar is secure. The core is now rammed up to the mouth of kettle and a parting made at this point after which the nowel is rammed up complete and struck off level.

the latter is given a light rap to start it backwards a bit and prevent it from sticking to the cross-bar when the nowel is lifted. After drawing the nowel half of the pattern, a carpet tack is placed

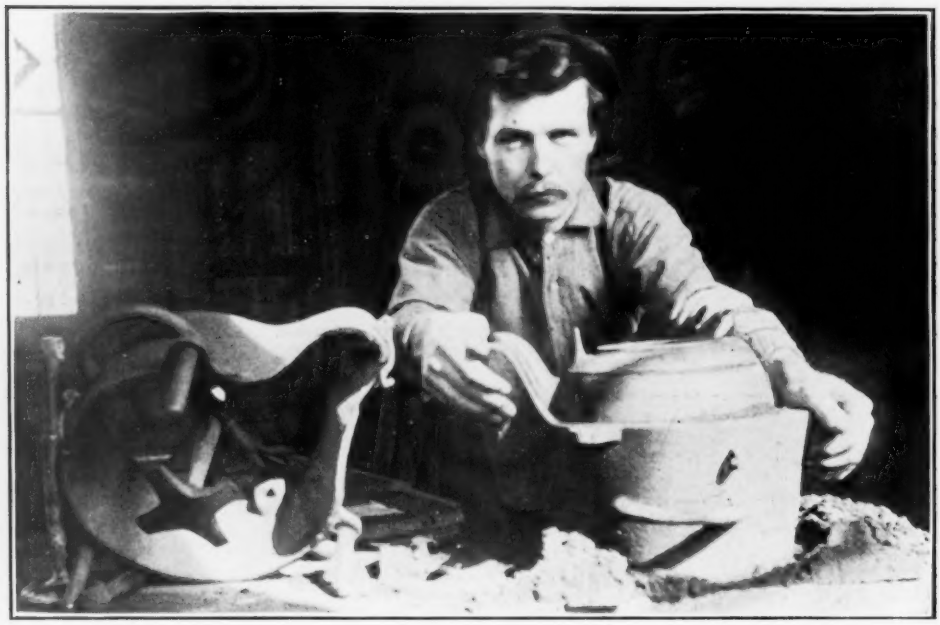


FIG. 2—MOLDING A TEA KETTLE.

The nowel is now rammed up complete and all that remains is to take the mold apart and remove the pattern (see Figure

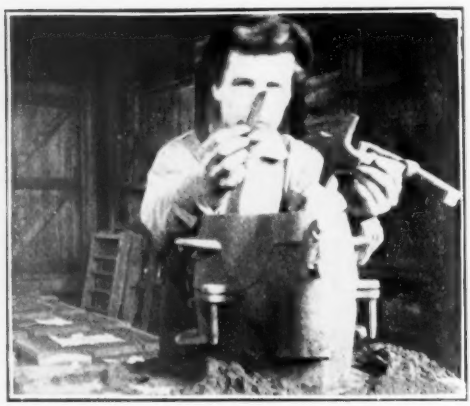


FIG. 3—MOLDING A TEA KETTLE.

4). Before the nowel can be lifted off it is necessary to drive out the key supporting the anchor, after which

about three quarters of an inch from the end of the spout as a chaplet to support the spout core after the mold is turned over. When the nowel is returned and the flask hooked together (flasks for this kind of molding are generally provided with hooks, as shown in illustration, to facilitate molding) the key is put back in its place and rapped lightly until the anchor is tight to the cross-bar when the bottom board is put on and the whole mold rolled over gently. The flask is now unhooked, cope lifted off and the bottom half of the tea kettle removed when the mold is finished (see Figure 5).

In our experience we find that soap stone facing works well on this class of work, as it will not run or make a cold shut casting. We also use cores to form the holes in the lugs, as this is cheaper than boring same. The main thing in molding tea kettles is to vent the spout and core of tea kettle well around the anchor. The sand should be of about the same temper as that used for stove plate and if anything, a little on the dry side.

Something About Foundry Office Work—The Recording of Wages.

By A FOUNDRY CLERK.

There is a wide range from the primitive way, in use by a lady who may try to keep a record of the hired girl's wages up to the complicated way in a firm with hundreds of employes. When therefore we compare the little pocket memorandum of the lady with the pay roll of a large establishment, it seems there is no relation whatever between the two; indeed this only seems to be so, but as a fact I may give it as my opinion that there is no difference in the two instruments.

FIG. 4—MOLDING A TEA KETTLE.

Whenever labor is hired conditions come into existence and when a wage record is laid out such existing conditions bring about the form of it with regard to the foundry trade, we find in most cases the following conditions in existence:

1. A certain rate per hour, per piece, per ton.

2. Payment of wages by week, by fortnight, by month.

3. The time which may elapse between the closing of the time record and the payment of wages.

It will not do when we simply record the number of hours, pieces or tons without giving the day, the month and the year when labor was engaged. The form of a wage record is very simple after all, and it would be useless to go into further explanation. But as this instrument will change its character into a pay roll, after the recorded time pieces or tons are added up and multiplied by the rate, I find that I should say a little more about a pay roll made out of the wage record. A foundry pay roll should not only show the items of each man but his classification also, because the high-priced molder and coremaker as well as the common laborers unloading pig iron are engaged in the manufacture of our product. When labor is thus classified we secure the average hour rate for each class, after the piece and tonnage work is figured up into the respective hours it took to do that class of work. Now in order that I may show the advantage of a classified hour rate, I will show its practical use in the following:

Supposing a large establishment with one monthly pay day would like to know six days before the closing of the time record what the pay roll may amount to. I will add up the hours for nineteen days in each class from the rate the month before, I find a rate, this rate I will compare with the way we run now, and with the help of the foreman or manager fix an estimated rate for the nineteen days. I find the amount for nineteen days again I estimate on the average run for the following six days. I can assure the reader that from practical experience I had good success in making a

near estimate. Should it be found that the pay roll is running too high, or on the contrary the firm is also to go still higher, the foreman is given six days in which to comply with the wishes of a firm. A pay roll without classification will take just as much time to finish as the one with, and I have often wondered why this is neglected in some places, there is not the least so-called monkey work about it, as the practical man will admit.

A well made up pay roll is worth of storing away no doubt once in a while it may be taken from the shelve for reference, the same as the foundry sheets, the former are records of production the latter will serve as a record for wages.

FIG. 5—MOLDING A TEA KETTLE.

Brass Foundry Practice.

BY K. K.

In brass founding, as in most everything else, there are many ways of reaching the end sought. Different foundries have different methods of accomplishing a desired result, because two minds rarely view a given subject from the same point. Consequently opinions differ, and we hear one man find fault with what another man may regard as being entirely satisfactory.

Such being the case, the writer is not opinionated enough to claim that the methods of working illustrated in this article are the only ones possible, or, even the best, but simply that they are the best that his own experience has so far taught himself. That they are capable of producing good results and as such, may be of sufficient interest to be entitled to the consideration of practical men.

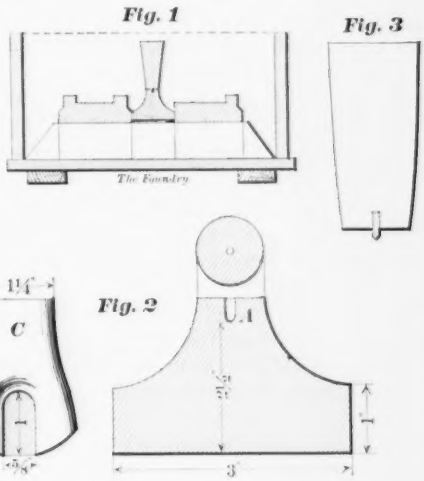
Let us suppose that a concern in the business of manufacturing steam engines and heavy machinery generally has decided to establish their own brass foundry. The more staple part of their work will consist largely of bearings, key heads, stems, etc.

Orders will be constantly coming in on these articles and although the patterns are of such a character that we cannot "gate" or match-plate them, we can rig up for them so as to save considerable labor. Take the bearings for example, they are generally cast in halves, and we can put the two halves in one flask, and run them with one sprue. Some are "babbitted," and some are solid, but they are all cast bearing down, and are wholly in the cope. Consequently it will pay us to construct special flasks for these things with a very deep cope and a shallow drag, and varying in size to suit the different sizes of patterns. If we make these flasks of iron, strong enough to withstand hard usage, they are going to be very

heavy, especially for the larger patterns. Experience has taught us that wooden flasks are best in this case. The copes should be deep enough to allow of from 3 to 5 inches of sand, over the top of pattern, according to their size, so as to get the pressure requisite to obtain a perfect casting. For all flasks to be handled on the "tub" or bench, use 2" undressed pine, make them square and put bars across the ends of the cope for handles so that one man can lift them. Bind iron strips on the top edges, to prevent burning out when the pot is rested on the top while pouring, and pin a row of nails inside at the joint to prevent such a thing as a "drop out" when closing. No bars will be necessary except in the larger sizes. The flasks to be used on the floor should in regard to handles be made the same as any other wooden floor flasks as they will be handled by two or more men in lifting off, etc.

The next thing to do is to shape some blocks of wood to fit the arcs of the different sized bearings so that when we lay these on our smooth board we have a "follow board" that is going to save lots of trouble in making the joint. Not only this, but they are absolutely necessary if we intend using "set gates" as I should imagine we are. Fig. 1 shows block, patterns and set gate, with sprue pattern in place on follow board in section with cope placed over ready for ramming. We will now turn our attention to the set gates; make them of either wood or aluminum, white metal will be too heavy. Fig. 2 illustrates the set gates. If desired the pattern can be made of plaster of Paris, mold it when in a pasty condition, roughly, to the desired shape, as required. About four different sizes of set gates will be required for work on the bench. Make the pattern suitable for the larger boxes, cast one off it, then whittle the pattern down to the next size and so on. Suppose the larger boxes (molded on bench), weigh 30 pounds each, then the amount of gate required will be as shown by cut C, Fig. 2. Fig. 3 shows the wooden sprue pattern, these should be long enough to reach from the top of set gate to within 1-4 inch of the top of cope, the reason they are not the full length will be shown later on. The bottom of the gate stick should be of the same size as the top of set gate, and should contain a pin, to fit into the hole A in the gate, to prevent the stick shifting during ramming. Let this gate pin gradually taper up to about 2" at the top for the smaller ones. Now that we have got our flasks, boards, blocks, set gates, and sprue sticks we are ready to commence the work of molding.

Arrange the whole business with the exception of sprue as shown. After wetting the cope place over and sieve in sand. It must be rammed nice and firm around the sides and we had better nail all doubtful points with fourpenny nails to prevent "washing." After we have rammed up to the top of patterns it is time to place the gate stick in position then fill in and finish ramming, and be sure and don't pene over the backs of your patterns, they must be rammed firm over this point, but not hard, or else the castings will most probably be



"shrunk." Now bed on a smooth board, and before rolling over scrape the sand off the top of runner stick. After rolling dress the joint and drive forty-penny spikes, whenever you think it necessary into the sand, around the patterns in the larger molds. The set gate will be on a level with, or, if the block is small, a little higher than the patterns, pound it down, to about an eighth of an inch below the bearings. This is the reason we made the gate stick shorter than height of cope, and removed the sand from its top.

This "pressing down" of gate will go a long way in preventing "breaking in" when we break the gate off the hot castings. Then make the parting and ram up the drag, after bedding on the bottom board, remove and scoop out a channel in the sand,

over the bearings. Vent down to the patterns, with a fine vent wire, then just rub your fingers over the holes to close them. This will prevent a "run out" if the metal gets into any of the vents. Roll the mold over, take off the board from the cope, withdraw sprue stick, and widen out the head. On the larger boxes a little venting over the backs is a good thing. We then lift off the cope, draw the patterns and finish the mold. This finishing means to carefully slick the bearing, round off all corners, seeing that everything is firm, and fillet the gate. It is not necessary to put on much of a fillet, or, when we break off we shall have a big chunk of gate sticking to the casting that will have to be chipped off. Indeed it is a matter of opinion whether it is not best to break off the gate when cold, by first nicking it with a chisel, and then using the sledge. If we do this, we certainly avoid all breaking in risks, and save chipping and burning.

Before closing see that the sprue is clean, not merely by blowing through it, but by slicking with a hub slick or suitable tool. The writer made a very handy tool for this job by taking a long 3-4 inch hub slick, cutting off the heel and filing the other end round like the top of a spoon and giving the whole a slight bend like a bow. If the box is a "solid" the metal must be poured hot to avoid shrinkage on the back, but if a "babbitt," being thinner, it can be poured cooler, so that the casting will be more smooth.

Modern Foundry Practice.

Twenty-five years ago it was customary to look to England or Scotland for our foundrymen ,and they were picked men who had to serve a seven-year or more apprenticeship. At that time it was an essential feature that he should have a thorough knowledge of the manipulation of iron in both light and heavy work in all their details. But the present practice is radically different, and the foundry foreman, like the molder, has developed into a specialist, although he is no less a mechanic. The foundryman who has devoted his entire time to light work, has very little idea as to the requirements of a heavy machine shop, writes "Ferro," in the "Industrial World."

The foundryman who has a thorough practical knowledge of the production of heavy mining machinery, etc., would be likewise lost in a modern foundry where all work is gated and light, each instance requiring peculiar conditions with which the other would be unfamiliar. The conditions of mixing and melting are different also, and although each may be an expert in his own line, when they both meet and enter into discussions of foundry practice, they leave with the impression that the other fellow "aint in it."

Improved machinery is cutting quite an important figure in both cases, the heavier work being handled by electric cranes, air hoists, pneumatic chippers and cleaners and other labor-saving devices with which the foundryman must become familiar. The lighter work has its stripping plates, compressed air machines, sand riddles, iron conveyors, and electric appliances for different purposes, and many little devices for reducing cost of production which were not thought of a few years ago. There is still room for improvement in most foundries. Quite a number of good molding machines are on the market, which, with proper care and manipulation on the part of the foreman and a little backbone, will increase the output 100 per cent at the same cost.

Carrying iron by hand with three men, should be relegated to the past, when so mnay good carriers are offered for the purpose which will deliver the iron at the molder's floor quickly, safely and hot, and the cost is comparatively a trifle by the side of the old methods. The riddling and mixing of sand and facing by hand is surely a waste of time and money, when devices for that purpose are offered which are no longer an experiment.

Electricity is playing an important part in some foundries, being used not only for light and lifting power, but furnishing power for the blower, enabling the foundryman to place it convenient to the cupola, doing away with the loss by friction where the blast is required to travel a long distance, owing to the location of suitable countershafting.

Compressed air is also proving a valuable assistant in some foundries, both for molding and handling, and is not necessarily as expensive as most people are led to believe. With the compressor once placed, it is surprising for how many different purposes it may be used, being clean, safe and as easily handled as water or gas.

The practical fuondryman of to-day also finds that if he wants to keep even with his

neighbor, he will have to improve on his old methods of mixing his metals, and must have at least an elementary knowledge of the effects of the different metalloids, and at least occasionally call in the assistance of the chemist. But meet the "old-timer" and he will tell you he always had as good results without these things, and conditions are not the same as they were in his time. The molder don't know as much; the foreman don't know as much; and there was no need of a "doctor" in his business. But in those days better prices were paid for castings, and the requirements were not as close. Competition is also greater now, and it is a well-known fact that the manipulation of mixtures for the purpose of cheaper production did not exist then as now. Therefore it behooves the sensible foundryman to keep up to date, keeping track of the new appliances of the present day, and taking advantage of them in his own practice, thus enabling him to keep out of the rut.

How Apprentices Are Taken in England.

In the course of an article upon the profession of mechanical engineering, The Engineer, London, has this information as to the taking of apprentices in England:

"There are three ways of 'going through the shops.' According to the first, a premium is paid, which varies in amount from fifty to one thousand guineas. The pupil gives three years in the shops, during which time he is supposed to pass through all the departments, beginning with pattern making, and to have at least six months in the drawing office. Under the second no premium is paid. The pupil receives small weekly wages, and at the end of three years receives a certificate, which is equivalent to indentures. Under the third, the pupil pays a small premium, usually about $125, and is taught in the shops a trade; that is to say, to be a fitter or a turner or a patternmaker. He does not learn the profession; but a sharp youth, who keeps his eyes open, is well educated, and reads and attends drawing classes in the evening, may learn quite as much as 'the gentleman apprentice'—not unfrequently a good deal more. The practice varies with different localities; a line drawn across England from Liverpool to The Wash roughly divides the northern shops, in which no premiums are taken, from the south, where premiums are received. There is much to be said for both systems, but that is quite another story.

For some years past it has been almost impossible to get a boy into the shops; that is to say, into desirable shops, where there is something really to be learned, and to have passed through which gives a man the guinea stamp in itself. In such establishments the number of apprentices is limited, because a conscientious endeavor is made to teach them. The result is that an outsider has practically no chance of getting his son in; nothing but interest will suffice. We can name, for example, one first-class northern shop now. Every vacancy for the next five years has been booked, and this is by no means a peculiar case. Parents and guardians will do well to exercise extreme caution in dealing with firms or individuals who advertise for pupils. In a few, a very few cases, rising young firms, glad to get a few hundreds in the way of premiums, and to secure the services of smart young fellows, advertise. For it must not be forgotten that a man nearly out of his time may be as good or better than a 'tradesman' who receives three times as much wages. It also remains to add that there is still some 'room at the top,' although not so much as existed once; that is to say, that, in mechanical engineering, as in all professions, certain men will achieve success by their own inherent capacity. As a rule, however, it will be found that the position occupied by mechanical engineers is very much the result of more or less interest and aid from friends."

Specifications for Malleable Castings.*

The rapid growth of the use of malleable iron castings in car and locomotive construction has been brought about principally through constant and material reductions in their selling cost, the former great difference in cost between gray and malleable iron castings having largely disappeared. There is still an average difference of about 1¼ cents per pound between gray and malleable iron, but this difference quite disappears in the net costs, a malleable casting of a given pattern weighing sometimes 60 per cent. less than the corresponding gray iron castings.

Now, the danger is that advantage will be taken of sacrificing the quality of the ma-

*Extracts from a paper by C. L. Sullivan, National Malleable Castings Company, read at the February meeting of the Western Railway Club.

terial, of turning out carelessly and insufficiently cleaned and annealed castings. One way to check the downward tendency of prices and thus save the quality is for purchasers to buy under rigid specifications.

The practice that is followed in gray iron work in casting a test piece in the same mold with the casting proper can hardly be followed in getting malleable iron test pieces. The condition of gray iron castings is supposed to be uniform throughout in a given casting or in any number of castings from a variety of patterns representing thick and thin sections, while in malleable castings the annealing is most effective on thin sections. Therefore a solid test piece of malleable iron would hardly represent a lot of malleable castings from a variety of patterns; and a ribbed and cored test piece that would fairly represent such a lot of castings would be nearly as difficult to make. These are the principal reasons for recommending that test pieces shall be taken out of a finished casting; one or more pieces from different castings (patterns) to be taken at the option of the inspector. Of course, in this we would lose the benefit of the skin at the planed edges.

A casting should be selected from a miscellaneous lot that would give a test piece with the smallest section at or near the middle of the piece; this is to insure the piece not breaking in the jaws of the machine in tensile testing and to prevent it from breaking on the supports in transverse testing. As there is but little, if any, reduction of area, the cross section area may be left for determination after breakage. This allows of test pieces being taken out through flats, ribs, fillets and coring.

In 1891 and 1892 a committee of the Master Car Builders' Association reported the results of some tests on specimens of malleable iron castings. The finding of the committee was for a tensile strength of from 25,000 to 34,000 pounds per square inch. Since then a considerable advance has been made, and we are justified in expecting better things. The figures for tensile strength that I will recommend are not as high as one manufacturer has expressed a willingness and ability to guarantee. The specifications submitted for discussion and possible revision are as follows:

TENSILE REQUIREMENTS.

At the option of the inspector, one, two, or three castings of either one or different patterns shall be selected from each 2,000 pounds of finished product. From one or all of the castings thus selected test pieces shall be cut and prepared, one from each selected casting. The position in the casting from which the test piece shall be cut is to be determined by the inspector. The size of the test piece shall be, as nearly as possible, such as will give, when the piece is prepared, a uniform clear length of 4 inches between the grips of the testing machine, and such as will give, as nearly as possible, a cross section area of ½ square inch. Tests of one or each of the pieces thus prepared shall show a tensile strength of not less than 40,000 pounds and not more than 47,000 per square inch. The elongation and reduction of area measured after fracture shall be distinctly noticeable as indicating some degree of ductility, and should be at least 1.5 per cent. for each. Should the average of three tests show a tensile strength below 43,000 pounds, and coupled with this, if ductility is not plainly discernible, the inspector shall have the option of repeating the test.

TRANSVERSE REQUIREMENTS.

Besides the tensile tests, transverse tests shall be made as follows: From the same castings, or others, at the option of the inspector, one, two, or three test pieces shall be prepared, giving a length of 12 inches between centers of supports and having as nearly as possible a cross-section of 1 inch square. If there should be any difference in the dimensions of the sides, the piece should be set in the machine with the greater dimensions vertical.

The supports shall be 12 inches apart, center to center, and of the usual shape for making transverse tests of gray iron castings. Tests of one or each of the test pieces thus prepared shall show an ultimate transverse strength of from 3,900 to 4,800 pounds per square inch, and deflections from 0.35 to 0.65 inch. The average breaking load for any number of tests should be about 4,900 pounds per square inch and the average deflection about 0.5 inch; this for specimens of the sizes recommended and for a metal of the characteristics suitable for car castings.

The fractures in both tensile and transverse tests should be fine grained and uniform; blow holes should be absent; bright edges like the chill in chilled castings should generally show distinctly at the edges; the

center should generally appear almost as dark as burned iron. No great dependence, however, can be put upon an examination of the fracture in determining the quality of malleable castings, further than seeing that castings are of uniform fine grain and free from blow holes, as the fracture will vary in appearance according to the size of the section.

BENDING AND TORSIONAL TESTS.

Malleable castings which successfully pass the above requirements in tensional and transverse tests will generally successfully pass bending and torsional tests of equivalent severity. Reasonably thin sections, about 3-16 to 9-16 inch thick by about 1 to 3 inches wide, should bend over on themselves around a circle at the bend equal in diameter to twice the thickness of the piece and back again straight. And in torsion a thin piece of uniform dimensions, or nearly so, should twist once around without fracture. It only requires proper mixtures and proper annealing, coupled with care in other particulars, to make malleable castings that will weld on themselves; that will draw out to a knife edge on an anvil under a hammer, that will temper and cut soft iron like a cold chisel. Such castings, however, cannot be had at the prices at which some malleable castings are quoted, and probably such qualities are not required in car castings.

NOTES AND INSTRUCTIONS TO INSPECTORS.

All tests should be made at the place of manufacture prior to the shipment of the castings. Extra castings from which to cut test pieces cast in molds, and the preparation of test pieces, shall be made at the expense of the manufacturers.

Test pieces cast in molds are to be furnished, if required.

If manufacturers have no means of making tests, the expense of making tests elsewhere shall be borne equally by manufacturer and purchaser.

Purchasers should have a knowledge of the reputation for the quality of work of the several malleable foundries.

Planed and turned test pieces should be tested occasionally to determine the penetrative effect of annealing.

The effect of suddenly applied loads, corresponding to shocks, should be determined by some convenient tests.

In carload shipments the inspector is to determine whether but three test pieces shall represent the carload. If a carload is made up of such a great variety of patterns as not to be fairly represented by three test pieces, and if there is any doubt in the mind of the inspector as to the uniformity of product in the carload lot, he shall test enough pieces to fairly represent the whole lot.

It is almost impossible from the limited amount of information on the subject of malleable castings to determine upon requirements in bending and torsional tests. It is quite certain that one set of requirements will not do for general car and locomotive, machine and agricultural castings. As we are dealing with railroad castings, our requirements are made to fit them only.

If patterns are furnished by manufacturers, inspectors shall insist that all abrupt changes in forms shall be relieved by fillets.

In case of duplicate patterns, castings from same shall compare closely in weight.

All castings shall compare closely with guaranteed weights when in competition with gray iron castings.

Beside making tensile and other tests, inspectors shall closely inspect all castings; rejecting all that show unmistakable defects, such as shrinkage cracks, large ridges at partings, evidence of blow holes, castings badly warped, cracked or broken castings, castings not properly cleaned, castings that are incorrect in important dimensions due to errors in patterns, castings requiring cleaning, pickling or machining not previously agreed upon.

The Development of Lake Superior Iron Ores.*

By D. H. BACON.

Down to late in the 50's the ore-product of Lake Superior was handled over a mule-tram-road to Marquette; now the Duluth, South Shore & Atlantic, the Chicago & Northwestern, the Wiconsin Central, the Duluth, Superior & Western, the Duluth, Mesabi & Northern, the Duluth & Iron Range and the Lake Superior & Ishpeming railroads serve the shippers. Down to nearly 1870 a 700-ton ship was an enormous craft, the unloading of which required two days; the unloading being seldom accomplished in that time. In 1871 the largest ore-barge carried 1,050 tons and made twelve trips per

*A paper read at the Duluth meeting of the American Institute of Mining Engineers.

season. Now the cargoes reach 5,000 tons, the loading requiring less than three hours, and the unloading ten hours. Now the mines cover more land than was familiar to even the "timber-cruiser" when the Jackson mine was opened. The annual shipments have grown from a few thousand to 10,000,000 tons, and the ability of the mines to produce is not taxed. Lake-freights are at one-eighth, and rail-freights at one-quarter, of early prices.

The deeper waterways, commodious locks and large ships of to-day are in a greater measure due to the movements of ore than to any other cause. Great savings have been made in each detail of each department. The only item of cost that has not been lessened, I am glad to say, is the money paid to men. Wages, measured by what they will buy, are as high now as at any time past, unless it was a time of feverish activity.

As illustrating the cheapening that has been effected, ore is to-day sold at Lake Erie ports for one dollar per ton less than in early times it actually cost to mine it; and this is done without loss, and further economies may be expected. Young men remember sales of ore in Pittsburg at $18 per ton, or about the present price of rails.

The first mines were opened in Marquette county and produced what is commonly known as "hard ore." Previous to 1873, "soft ore," or hematite, was not popular, but the buyer was often obliged to take some, in order to secure the needed quantity of hard ore. In those good old days, the ore-buyers came to the sellers as penitents approach a shrine, but I am told that custom in this respect has changed somewhat of late.

Beginning with a few grades, the Lake Superior mines now offer ores ranging from the purest and best to those that will not bear transportation; and within these limits can be found the varieties needed for general and special products, in quantity equal to any demand. The men who were early in charge of the mines had some knowledge of mining and quarrying. Many of their methods are now out of date; but experience, daily observation and study, technical schools and the mechanical ability common among Americans, have enabled those in charge to meet all difficulties and to carry the industry to a degree of perfection that is complimented by visitors from abroad. In the discovery of new fields, the miner of iron-ore, like the miner of more precious metals, has led the way; the explanation of the geology being left to the student.

As viewed from the distance, the early methods of mining were very crude. Horses furnished the power; and they were worked in all possible places. The little machinery then in use was poor and often but ill-adapted to the work. The first hoisting-plant of large size, economical design and capacity equal to future demands was set up at the Lake Superior mine in 1880. Now single, compound, triple and condensing-engines of large power are found throughout the iron-ranges for hoisting, pumping and compressing. The striking-hammer has been supplanted by the power-drill, and electric motors and rope-haulage are common above and below ground. Underhand, back and breast-stoping, square-sets, saving-sets, saddle-backs and milling-and-filling are common. Steam-shovels and locomotives have taken the place of hand-shovels and carts. Every known system has been or is in use. Many mines have presented difficulties that, in the early days, would have been considered insurmountable; but each has been overcome. To one closely identified with this industry for nearly 30 years, no single change has seemed important, and only by looking backward can one measure the advance. The early operators had little knowledge of ore-deposits, their position in relation to associated rocks, their dip, pitch, strike, depth and many other facts, an understanding of which is necessary to continued success. This knowledge has been acquired; and with it have come right courage, true economy instead of parsimony, the general development of ore-supplies far beyond immediate needs, and a thoughtful preparation for the future.

Nitroglycerine and power-drills have done more to reduce cost than any other two improvements. In 1871 a drift was driven at the Cleveland mine at a cost of $100 per foot. Now the cost would not exceed $16. In one case men were harnessed to a derrick-sweep. Heavy rains were nearly always followed by a few days of idleness and the pumps were expected to freeze every cold night.

In speaking of mining methods, I have mentioned the "caving system," which several claimed to have invented or introduced. The first ore taken out by this method was mined at the Cleveland hematite mine in

1883. The ore was very soft, with treacherous walls; and Mr. G. W. Wallace, the superintendent, tried what some of his men said was successful under the conditions in England. It proved satisfactory, and is now known as the "caving-system." Mr. John Pengilly was sent to the Cleveland hematite mine to learn the method, so that he might use it at the Brotherton mine.

The discovery and quick development of the Mesabi profoundly affected the iron and steel industry of this country; and the effect may extend beyond our shores. Each era of depression brings a reward in the better methods which are forced upon us, and which, continued into days of prosperity, increase the volume of business and to that extent the profits. With the low prices that are here to remain, it is more than ever difficult to estimate the annual consumption. Speaking of the several ranges as one, the acreage of known ore is but a small part of the area that may contain ore. Discoveries are still being made in the Marquette district, the exhaustion of which was expected 20 years ago. And I may say, in passing, that the known ore under the bed of Lake Angeline is four times as great as was all the known ore in all of the mines of that country at any time prior to 1887. The past few years have not been such as encourage prospecting; but given favorable conditions, we may confidently depend upon important discoveries. For 40 years this region has met all demands; its resources are to-day, as compared with demand, greater than at any time past; and I believe that those who are now active will have stepped aside and will perhaps have been forgotten before this region will fail as an adequate source of supply.

Some Early Stoves.

Previous to 1835 the stove was too much in the nature of a luxury to admit of its common use in this country. Schoolhouses were supplied with them, but plenty of people now living can remember when churches were half-heated by fireplaces. In the taverns and stores the sturdy men of the vicinity would assemble for the warmth to be found in no room of their home except the kitchen. In a circle around a red-hot "cannon" stove they would sit for hours, conscientiously deliberating over matters of common interest, and perfecting themselves in accuracy and force of spitting. Incidentally, the less important American necessity for pedal elevation while sitting was developed during the same time.

Benjamin Franklin invented the stove which contributes to his fame in 1745. It was many decades, however, before the stove attained any popularity in this country. Numbers of specimens of it are in use in old residences, particularly in the East and South. It is hardly more than knee high, with an open front. Its flue generally sits horizontally, connecting with a chimney close at hand. In almost every case it will be found that this little stove is the successor of the fireplace; its open face, allowing a view of the wood fire, preserved a portion of the fireplace's hearty cheer. The benefit offered by the stove was in the matter of economy of fuel.

Courthouses were early users of the stove, the Capitol at Richmond still containing one dated 1770. It was imported from Holland. The heat was distributed into air-boxes having access to a considerable radiating surface before it was finally turned into the flue.

Up to 1832 stove castings were made directly from the iron ore in blast furnaces. In the processes of casting, the experiment was tried of making stove castings from pig iron. In spite of contrary predictions, the experiment was a success. The entire new process was taken up by Jordan L. Mott of New York. Through his activity and that of Joel Rathbone, Albany received the beginings of its present importance in stove manufacture. With the decreased expense of stoves, and the new possibilities of smoothness and lightness, the popularity of stoves took a decided step in advance.

Schools and churches of the Western region were warmed by enormous stoves in the shape of cylinders, set horizontally. At the base of the pipe was a huge "drum," whose vast surface was of great assistance in the radiation of the heat. The length of these stoves admitted a considerable section of the trunk of a well-grown tree. It was found, when the occasion came, that they could be adapted to the use of coal, and so effective were they that there still may be found a great number of them that have held their place against the more convenient base burner.

Another stove that took a firm hold, especially in such places as country railroad

stations, hotel offices, and the like, was the "cannon." The derivation is from a fancied resemblance to a mortar. The stove consists essentially of two heavy cup-shaped pieces, the upper of which rests in a groove in the rim of the lower. The whole is topped by a radiating "drum," in size slightly less than the stove itself. Every victim of an enforced spell of waiting in a country railroad station at this season of the year has experienced the questionable advantages of the "cannon" stove.

Dr. Neil Arnott, the eminent British philosopher and philanthropist, was first to see the possibilities in a device for base-burning and self-feeding. He also invented a grate which permitted the removal of clinkers without the extinction of the fire. Joel Rathbone began the manufacture of baseburners at Albany, in 1835, and the notoriety of the town has rested equally on baseburners and New York Legislatures ever since.—Industrial World.

Trade Unions and Political Economy.

When the unions were first formed, British workmen were scholastically uneducated, and few of them were able to read or write; of the few who could do so, a still more limited number had access to any books of standard worth. Even the employers of half a century ago had frequently received far inferior education to that now obtained by a seventh-standard boy in a board school. The masters were often oppressive, and sometimes brutal; wages were paid irregularly, and partly by orders on the truck shop; and the rulers of the country had no higher view of good government than the suppression of riot and anarchy.

From such uncouth materials as these workmen arose the earlier unions; from the more impulsive and desperate of them were selected the leaders. The creed which they adopted was, of necessity, a narrow one. They saw despotic masters, and opposed oppression by strikes and brutality; they beheld accumulating wealth, and answered it by increased loyalty to their unions. Loyalty to the union of their trade became, indeed, a fetich with them, and not intelligent fidelity or necessary combination.

The conditions are now altogether changed. The masters are more altruistic, and the workmen both can, and do, read and write; but the fetich remains, and the men and their leaders imagine they have still to struggle against "unreasoning assertion of dominance and lawless independence" on the part of employers. With such a creed dominating the work people, it is but natural that the greatest demagogue, the most blatant orator, calm and thoughtful reasoner, who can see some good in both sides of the question.

The truth is, the men hear only one side, and read only newspapers which confirm their own views, and urge them to persist in their claims and in obstinate opposition to their employers. The fault is not entirely with the men. In the evolution of society a stronger line of demarcation than of old has grown up between master and man; the old feudal tie of service and protection, with its mutual respect and sympathy, has been exchanged for the commercial idea of free contract, and purchase in the cheapest market. A change like this, especially when combined with increased intelligence and education among the working classes, demanded great watchfulness on the part of the capitalists, and some method of communication between the two, some mode of keeping touch, when the old familiar lines had become obliterated. Had this been done wisely, and courteously, the general body of workmen would have gained a knowledge of the discoveries and conclusions of statistical and economic science. As it is, they know little of the work of the economists, except such distorted presentments as they obtain from socialist newspapers or socialist orators.—Francis G. Burton, in Cassier's Magazine for April.

How They Meet Competition in South Dakota.

Homer Charles, of Central, is in the city for the purpose of making arrangements with the owners of the Rapid City foundry to purchase the property. It is not his intention to run the foundry as a foundry, but he will change it so that it will be a manufactory of mining pumps, brass castings, etc. He sold out his business in Central and believes he sees many advantages here in his favor. Labor may be obtained cheaper because the necessities of life are cheaper, and what is more moment to him, better sand for molding is to be procured. It is hoped that negotiations can be successfully consummated and Mr. Charles begin operations speedily.—(Rapid City (S. D.) Journal.)

THE FOUNDRY

Published Monthly by

"The Foundry Publishing Co."

DETROIT, MICH.

JOHN A. PENTON - - - EDITOR AND MANAGER.
HENRY HANSEN - - - - ASSOCIATE EDITOR.

SUBSCRIPTION PRICE:

$1.00 a year in advance, postage prepaid in the United States, Canada and Mexico.

$1.75 a year to other countries, postage prepaid.

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Entered at the Post Office at Detroit, Mich., as second-class matter.

Trade Outlook.

The rapid advance in the price of agricultural products and the stimulus which this will afford to trade in general has undoubtedly had much to do with the steady tone and increased activity to be found in the majority of industries.

What effect the war will have upon the export business of the country, as far as products of iron are concerned, remains to be seen. Neither Spain nor the United States have any merchant marine worth mentioning, consequently the export trade has in the past been carried largely in neutral bottoms, and present conditions will cause but little change as far as the carrying trade is concerned.

With a greater prosperity prevailing among the agricultural portion of our population, the manufacturers of agricultural implements naturally look forward to a greater purchasing power from the American farmer, who has a well-founded reputation for spending his money liberally. As the activity of one industry furnishes acceleration to many others, resulting in a growing impetus all around, the benefit accruing to the farmers will reflect itself in other lines.

As We See It.

Without in any way seeking to advertise an individual through his ideas or theories upon any subject, THE FOUNDRY has at all times stood ready to print all the facts connected with any discussion, without unbiased partiality. While there is room for improvement through all directions in the foundry, as there always will be, the fact remains that satisfactory castings are obtainable in the majority of shops and that the trade is a long way from being on the ragged edge of perdition that some printed matter would lead us to believe.

As there are two sides to every story, so there is more than one way by which a mixture of iron may be obtained that will satisfy the greater part of the trade. In their anxiety to create the impression that conditions existing in the foundry are unbearable, some persons ignore the fact entirely that the ordinary mixture of cast iron used for making gray iron castings may be regulated through another medium besides chemistry, namely, through a physical test by the measuring of shrinkage. Each of these systems has advocates and this is undoubtedly caused by the fact that, as the old saying is, "everything is right in the right place." While we are aware that many foundries, notably malleable and steel works, have obtained an additional profit through the aid received from chemistry, it does not appear to us that the universal instituting of chemistry should for that reason be expected to produce the same result in every foundry.

Without intending to disparage in the least the services rendered the trade by competent chemists, THE FOUNDRY feels it is in a position to tell the whole truth. Each shop may determine for itself by what method it obtains the best results at the least cost, for after all it is not a sympathy with this or that movement which will decide its utility, as the adoption of any practice resolves itself into a question of dollars and cents.

They Have Much to Learn.

The article appearing in the May FOUNDRY describing the conditions of the iron business in Japan and China and referring to the foundry interests of those countries, is particularly opportune to the American trade at this time in view of the attention

that is being bestowed upon the possibilities of those countries.

Some writers have kindly warned us that the day was not far distant when these Orientals would by some strange mysterious power, arrive at such a state of mechanical and scientific perfection as to enable them to sweep the markets of the world with their product. They would make everything from locomotives to watches at a cost that would put us here in America, with all our natural advantages, skilled mechanics, modern appliances, etc., entirely on the defensive.

A careful reading of this article will show that these nations by their manner to strangers, their business methods, their abnormal self esteem and exclusiveness are but little likely to ever disturb conditions for many decades.

And yet their air of superiority, their assumption of superior intelligence, is not unlike similar exhibitions seen in this and European countries where well known establishments adopt almost similar tactics in their business and methods.

It is well known that in sharp contrast to this policy we have that of many modern establishments who delight to show visitors everything and make a special effort to be agreeable on the basis that by so doing they advance rather than retard their own interests.

If the Japanese or John Chinaman hopes to compete with those countries whose commercial supremacy rules the world to-day, it would seem, judging from the article referred to, that they need first of all to set themselves to the task of being willing to learn to encourage the entrance into their countries of all those whose information or experience along any line might be of value to them.

Metallurgical Humbug.

The temptation to forget one's own opinion and honesty of conscience for the sake of obtaining a few paltry dollars is one often presented to publishers. . While frauds and nostrums can be disposed of without advertising, yet printers' ink give them a covering of respectability and aids them in carrying on their humbugging traffic as nothing else can do, because a publisher is morally, if not legally, expected to accept only legitimate advertisements.

One of our contemporaries is carrying the advertisement of one of the most notorious fraudulent parasites that ever infested the trade and in a late number it illustrates a "Pyritic Water-Jacketed Furnace," which in construction is far more ridiculous than the "Hornswoggler" systems. Its absurdity will be better appreciated when it is considered that this so-called "furnace" is intended to be operated without any lining. The ambiguity of the description accompanying the illustration is well calculated to befuddle the ordinary mortal, temporarily interested in metallurgy, when it says: "One of the objects sought is the utilization of the sulphur in the ore to the fullest possible extent as a fuel, during the process of smelting; another is to combine with a pyritic smelter, a fume condenser for collecting the volatile metals which leave the body of the smelted ore in the form of fumes, by the action of condensation and precipitation." The first thing we know some genius will tell the foundryman that the more sulphur there is in his pig iron and coke, the more these articles are worth. We are greatly surprised that a respectable trade journal should accept such stuff at any price.

The category of so-called semi-steel processes form a respectable percentage of the semi-swindles perpetrated upon semi-foundrymen whose thinking apparatus is in a semi-comatose condition. We cannot believe that any foundryman is fully awake who pays a royalty for the privilege of putting a little wrought iron or scrap steel into his mixture, and yet we are aware that bunco games are played upon apparently intelligent members of the trade. When foundrymen can be found who are willing to be taxed for being allowed to fire a shovelful or two of sand into the cupola, along with the charges, or for the supposed benefit of introducing moisture into the blast, it is evident that all fools are not yet dead.

Numerous fluxes for transferring the foundrymen's dollars to the pockets of others have been invented, and British trade papers have lately contained accounts of a "remedy" called "ferro-sodium," which were of course accompanied by "official" tests of the metal "before and after taking." Just like every patent nostrum intended to be swallowed by the gullible carries with it a sworn affidavit as to its curative powers, so every patent metallurgical fraud carries a test bar, exciting the wonder and admiration

of the uninitiated. Trade papers, hungry for a few dollars, will laud the impostors to the skies and publish biographical sketches and accounts of their "achievements" in obtaining "high tensile" or other "high" falluting metal. The test bar can be made to indicate most anything an unscrupulous impostor desires, and the test of time has shown that all of these "patent" processes succumb as soon as a small crop of "innocents" are harvested. Let those papers who become participants in these schemes remember that the processes they are helping to introduce will be "hung" as soon as given rope enough.

For Waukegan Girls.

A new occupation for girls is soon to be established in this city. Since the location of the brass works in this city the members of the firm have often contemplated putting on a force of girls at the core making bench in the foundry. Owing to the poor condition of the old foundry, it was never carried out. However, now that a new foundry has been erected and makes a most comfortable place in which to work it is the purpose of the company to engage girls to work at core making.

Perhaps many do not know the duties of a coremaker and wonder how girls can be employed at it. The work is very simple, but still is such that one may become an expert and so command a large salary. A sort of sand is used. This material is pressed into what are called core-boxes and baked. When finished, the coremaker's task is done. The cores are then used to form the brass castings by molders.

At the works in this city there are now employed about a dozen men and boys who do nothing but make cores. Throughout the country girls are now being employed in this capacity and they readily acquire more proficiency in the trade than do the male sex. There is good pay in the trade, a moderately fair worker making from $5 to $8 a week.

If this plan is carried out Mr. Thomas says that one end of the new foundry will be nicely fitted out and made a very desirable place for girls to be employed.—Waukegan (Ill.) Sun.

(The question of employing girls in factories of various kinds has in the past called forth a great deal of indignation, though no amount of sympathy is going to settle matters of this kind.

The editor of the "Sun" is a real philosopher. Instead of tearing his hair in a vain effort to prove that female labor is the ruination of the earth he finds that large salaries can be earned in making cores. We never knew before that a coremaker received a large salary, especially those engaged upon small work such as falls to the lot of the weaker sex. However, the editor of the "Sun" can settle this point for us by letting a few of his female friends work at coremaking for a couple of months, when he is likely to receive something of an eye-opener unless conditions have changed very much for the better in Illinois during the past few years.

The question of employing female labor in various industries hinges largely on dollars and cents from the employers' standpoint, and looking at the matter seriously, we do not see why the workingwoman does not look at the matter in the same light, as evidently she does not. Every newspaper we pick up contains columns of advertisements of vacant situations in private families and it has always puzzled us why a girl with an average share of common sense should seek to enter a dirty, ill-smelling core room when there are other chances for obtaining more money without smoke and grime. Why a girl should like to hammer core boxes around, keep her hands soaked in kerosene and her underwear saturated with sharp sand for the sake of earning two or three dollars a week in preference to doing housework, is one of the mysteries we have never been able to penetrate.

We never before had our attention called to the fact that female coremakers are "more proficient than those of the male sex," but will be under obligations to the "Sun" for any theories it can advance as to the cause thereof.—Ed.)

"Burning in" Brass Castings.

Whenever in the brass foundry a heavy casting is found "drawn" at the gate, or a large thin one with a small hole or "cold shut," the invariable reply of the molder to the "kick" of his foreman is: "Never mind, let me burn it in; I'll fix it all right," and if the man knows his business he is usually as good as his word, and if he doesn't he will spoil the casting. Probably it is this latter fact that has caused the burning-in

business to be looked upon with such disfavor in some shops, writes C. Vickers in Machinery. Of course, the causes which lead to the necessity of burning in are to be deplored, but as it is "human to err" we may reasonably expect such things to occur from time to time, and, when they do, it is a good thing to know how to remedy them. In the case of the heavy casting aforesaid, the job of burning-in may be easy or otherwise, according to the nature and size of the cavity.

Fig. 1

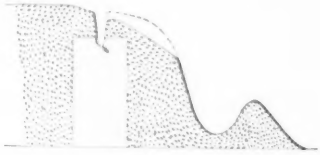


Fig. 2

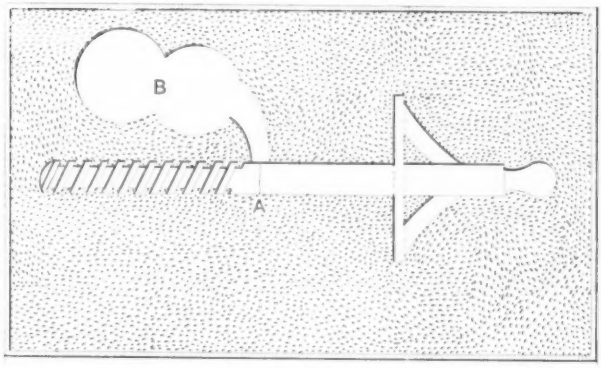
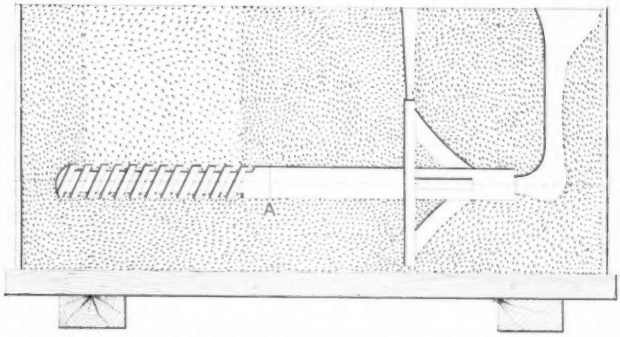


Fig. 3



Sand holes are the easiest to burn, as all the preparation that the casting needs is to scratch out the sand from the hole and expose the clean metal underneath. In many such cases the preparatory treatment can be quickly accomplished by grinding the spot out on an emery wheel. But in the case of a draw or blow-hole, the writer has found by experience that, in the majority of cases, such elementary treatment is insufficient. If the cavity is so small that it can be ground out, it is all right; but if it is deep this cannot be done. We may pour any amount of metal on, but in few cases will the burn be solid.

I have known instances when the burning was repeated half a dozen times and was then unsuccessful. Every time the surplus metal was ground off, the same old "worm" hole would appear, and by probing you would find that it corkscrewed way down into the casting. These troubles can be easily prevented however. First chip out the top of the overhanging cavity, as shown in Fig. 1, after which plug the "worm" holes with pieces of brass; vents are good for this purpose, and they must be pounded in solid with a blunt punch. I have also had good

results by filling the entire cavity with wax, and burning out, but I believe the plugging method is the surest. This preparatory treatment of the casting may look simple, but if neglected it often leads to a world of trouble. The burning in itself is very simple. The casting is merely bedded in the sand pile, or in a flask, as circumstance dictate, and a suitable piece of wood or core is placed over the spot where the burn is to be, and sand packed over the casting, all around it, to a depth of, say, one inch. The piece of wood is then withdrawn and all dirt blown out of the hole, after which a space is provided for the overflowing metal. Fig. 2, which is in section, explains the operation. In the case of a hole in a thin casting, the best method is to fill up the space with wax, smoothing it with a heated tool until it is level with the rest of the casting, after which it may be prepared for burning as above. The sand must be carefully tucked around the castings, especially under where the new metal is to be added. In the case of a large thin casting, weights must be placed thereon to prevent springing, and a very little metal must be flowed off, otherwise the casting will be cracked. Four or five pounds are plenty on a casting one-eighth inch in thickness. With a heavy casting a considerable amount of metal must be flowed off to make a good job. When it is thought enough metal has been used, wait a moment and look for signs of bubbling; if the metal lies quiet, the job is completed; if not, more metal must be poured over. If the bubbling still continues after this has been tried two or three times, the burn is a failure, the casting must be removed from the sand and the trouble located. When the casting has been well plugged, as recommended above, the difficulty will be caused by moisture condensed from the sand. In such a case the casting must be well dried before again bedding in the sand. A little kerosene dropped on the "burn" will always prevent this trouble.

The cases just illustrated are only simple forms of burning. Sometimes, in castings that have a flange united to the body by a comparatively thin neck, the neck will crack in cooling. Usually in such cases the defect is not discovered until work has been done on the casting in the finishing shop. If the article is thrown away at this stage the loss will be considerable. This can be saved by burning on a new flange. The cracked flange is removed, and the interior of the casting filled with sand, vented and then dried. The mold is constructed from the pattern in the usual manner, a gate being cut to carry the metal to the flange, and another to take it to a large riser, as shown in the illustration of the whistle stem in Fig. 3. When burning on flanges the gate must be so placed that the metal will acquire a rotary motion in the mold, and so come into contact with and cut away all portions of the protruding stem, thus insuring a solid union. The mold must not be closed until ready to pour, just previous to which the broken casting is placed in position. The metal must be poured hot. In a certain shop in which the writer was at one time employed, the disc on the stem of the whistle was worn out, or broken, I forget which. As this whistle was large, to save the expense of a new one, they determined to cast another stem. The old one was waxed up and a casting made from it, but was useless, because, as they had no tools to cut the thread on the stem they had cast it, and the shrinkage made it too small. As this was one of those shops where they did not practice burning, the idea would never have occurred to them. One of the molders mentioned it, however, and after explaining how it could be done, was allowed to try. He made a mold from the old stem, and after drawing the pattern, cut off the threaded portion, as shown at A, Fig. 3. At this point a gate was cut, communicating with a very large riser B, which was cut through the cope. When all was ready for pouring, the threaded portion, which had meanwhile been kept in a warm place, was placed in its proper position in the mold, which was then closed down, and poured in the usual manner. When the metal in the riser was congealed, it was broken out and returned to the furnace again. The casting when taken out was all that could be desired. By modifying the above process, a casting of brass can be made of different colors, by burning red brass on to yellow, and yellow on to copper, and the shades can be varied indefinitely according to the mixtures used.

For Another Year.

The conference committee of the Stove Founders' National Defense Association met with the corresponding committee of the

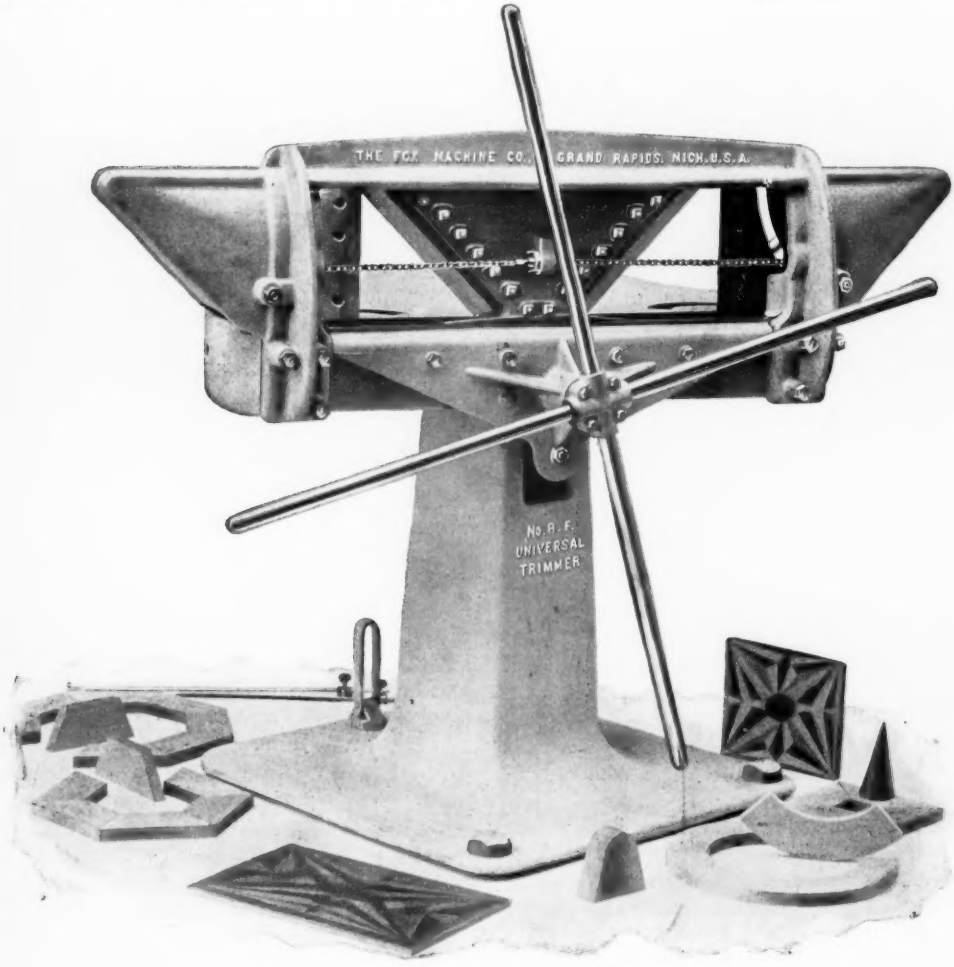
Iron Molders' Union of North America in Chicago on the 14th and 15th ult. The members of the former are Chauncey H. Castle, of Quincy; Henry Cribben, of Chicago; E. W. Peck, of Rochester; Jeremiah Dwyer, of Detroit; George H. Holland, of St. Louis; A. C. Mott, of Philadelphia, and T. J. Hogan, of Chicago. The members of the latter are Martin Fox, of Cincinnati; Martin Monahan, of Albany; Mr. Gray, of Quincy, and Mr. O'Neill, of Detroit. The labor situation was thoroughly discussed, but no changes were made in the wages of molders as prevailing for several years. The contract for the past year was renewed for the coming twelve months in all foundries in the United States covered by the Defense Association. This means no labor dispute in the stove trade, unless it happens in some foundry not connected with this organization.

The Fox Universal Trimmer.

The Universal Trimmer was first brought out by Mr. Fox in Connecticut in 1879. Like many other tools which afterwards have come into universal use its good qualities were not appreciated when it was first placed upon the market.

It is probable that no machine has wrought as great a revolution in pattern work as has been brought about by the introduction of the Universal Trimmer. It was looked upon by a great many as an experiment and considered to be an unnecessary luxury in pattern work and it was with the greatest difficulty that the manufacturers could be induced to put them into their factories.

In 1884 Mr. Fox took twelve machines to Chicago (delivered then on his shoulder) and succeeded in placing them in some of the factories there. He also induced such con-



No. 8 F Trimmer—Front View.

cerns as Pool & Hart, Brown & Sharpe, Yale & Towne and other representative firms in the east to give the machine a trial. When they once had an opportunity to demonstrate the labor saving qualities of the machine it was not difficult to get them to recommend it to others. From that time on the sale of this tool has been very rapid, the sales having reached over 10,000.

To meet the demands of the pattern makers it has been necessary to produce machines having a greater capacity and range of cut together with modifications and additions which experience has shown to be necessary.

No. 8 F Trimmer—Rear View.

The machine illustrated, which is known as the No. 8 F Trimmer seemingly covers the largest tool that would be demanded for this class of work. The hight of the cut is 8", the length of the stroke of the machine being 32½". In order to accomplish this long stroke there is used a heavy bicycle chain attached to the center of the carriage running over an eight (8) tooth sprocket at each end, and an 18 tooth sprocket on the main shaft.

An auxiliary sprocket is provided which keeps the chain in contact with the large sprocket making it impossible for it to slip. There are also means for keeping the chain at the proper tension. The handles are made of 1⅛" heavy tubing, closed at the ends and nickle plated. The machine can be handled with great rapidity either in taking a long or short cut.

The entire machine is made very heavy, its total weight being over 800 pounds. The bed is swiveled on the column and can be turned to any angle. The bed is 40" long and 24" wide making ample space for supporting the work.

The knives are protected by shields which

cover both sides and make it impossible for the operator to come in contact with the knife.

In order to move the machine conveniently from place to place in the factory it is placed on three casters; the caster in front attached to an eccentric lever is raised and lowered at the pleasure of the operator, but when the machine is in operation it rests on the four corners.

The above style of machine is made in two sizes, the same general principle of construction being carried out in each machine. The Fox Machine Co., of Grand Rapids, Mich., are the builders of these tools.

Technical Education.

The old saying that "a man can't know too much" has all the appearance of being sound reasoning, and yet, with our changing mobilization of industrial forces, we are somewhat inclined to believe that the man with a whole lot of general information is not as well fitted to succeed as the specialist, who knows how to do one thing well.

Many educational institutions throughout the country have added miniature black-

FIG. 1—FRESHMAN DRAWING ROOM, PURDUE UNIVERSITY.

smith, machine and pattern shops and foundries to their educational facilities, and through the kindness of Prof. M. J. Golden we are enabled to present some views of the pattern shop and foundry at Purdue University, Lafayette, Indiana. The general equipment of the foundry, as far as illustrated, has a familiar appearance, and the whole looks a little neater, perhaps, than the average country shop. At least, it looks better than some which have come under our observation.

As far as the teaching of the general principles of molding is concerned, technical institutions undoubtedly manage to leave an

FIG. 2—A CORNER OF THE PATTERN SHOP, PURDUE UNIVERSITY.

impression upon their students as to how a casting is made, but is this going far enough? Does it profit a young man anything to know how a thing is made unless he knows how to make it commercially? We will suppose that he is given the pattern of a brake shoe, rams it, draws the pattern and cuts the gate. Is this knowledge at par when a man could

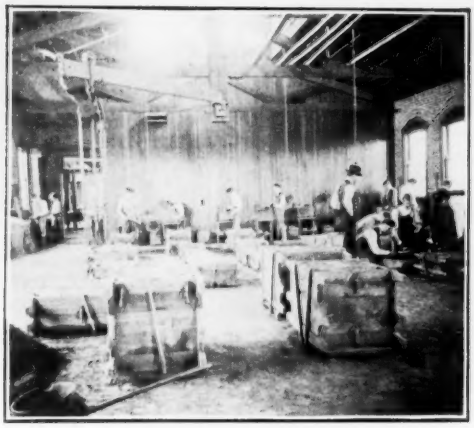


FIG. 3—PORTION OF FOUNDRY, PURDUE UNIVERSITY.

not possibly manufacture brake shoes in that manner and meet competition? Would it not be worth more to him to be told that molding machines and muscular mechanics, actuated by piecework, were turning castings of this kind out at a rate he could not meet in the old way of doing things.

We can imagine ourselves going into a machine shop and some fine old machinist showing us how to do an elegant job by hand. We might be interested in his skill and his ability, but would the information we gained be worth its price to us if we could buy an automatic machine which would turn out as much work in an hour as he did in a week? Is our knowledge of how a thing is done not likely to be considerably warped unless we have same imparted in the way that things are done to-day, in the way that business is actually carried on?

We said the general appearance of the equipment shown in the illustrations com-

FIG. 4—ANOTHER VIEW OF THE FOUNDRY AT PURDUE UNIVERSITY.

pared favorably with the average shop, but the seemingly sameness of the flasks causes us to believe that the effect of special appliances, for molding different castings, upon the cost of the output is not touched upon to the extent which it should be. Without in any way reflecting upon the instruction being furnished upon the foundryman's trade, we think that a greater variety of labor-saving methods in molding would render such instruction far more valuable than could possibly be expected where only the rudiments of the trade, as it used to be carried on, are taught.

The Views of a Stove Manufacturer.

Although the manufacture of stoves has become a specialty and the successful carrying on of this part of the foundry business requires considerable capital as well as personal skill and competent management, when compared to other branches of the trade, there is yet much of interest to the foundry fraternity at large in the questions which come up for discussion before the National Association of Stove Manufacturers. At the recent convention held in Philadelphia the president, Chas. S. Prizer, called attention to some of the benefits conferred upon members of the association, and to problems effecting the trade at large, from which we have condensed the following:

"Our organization has no power to enforce laws or edicts, or to coerce its members into the adoption of any business rule or policy; it is, and I am persuaded, will continue for a long time to be a purely voluntary association of men engaged in one common industry, laboring to lighten difficulties, subject to the same discouragement, trying to reach the same purpose, and seeking through their organization to foster a spirit of mutual confidence and helpfulness, and to enlighten and educate themselves as to the correct business principles and policies. Our organization can point out the correct path which, like the way of salvation, is straight and narrow, but it cannot compel its members to walk therein. It is certainly true that the National Association of Stove Manufacturers, like all human institutions, has failed to accomplish as great results as its friends and partisans have expected, and hoped for; yet its history cannot be reviewed, it seems to me, without arriving at the conclusion that it has been of great and permanent service to the industry it has represented. It is an interesting and suggestive fact that those who most persistently complain of the inadequate results attained through it, are those who, with a few notable exceptions, have themselves done least to promote its usefulness. It would be idle to deny that conditions in the stove manufacturing industry are discouraging to those whose capital is invested in the business, and the pressure of competition seems to be growing more strenuous every year. Yet I am convinced that our state would be even worse than it now is, if we had never had the educating and, so to speak, the civilizing influence of the National Manufacturers' Association.

"In formulating and publishing a clear and comprehensive system of computing costs, this organization has rendered a great and valuable service to the stove manufacturers of the country. This system of ascertaining the costs is used not only by members of the association, but also by a very large propor-

tion of non-members. It is possible, of course, to criticise this system, but it is a significant fact that its critics have in almost all cases been those who shrunk from the logical conclusions which its frank application would reveal, and none of those who found fault with this formula has yet brought forth a satisfactory substitute for it. The broad and wholesome lesson of our cost formula is that any correct system of computing costs must cover in each stove its just proportion of all the normal expenses of the business.

"This truth, simple and obvious as it now seems, was by many stove manufacturers but lately recognized, and by many not recognized at all, previous to the educational work of the Association on the cost question.

"The legitimate work of the Association, then, is to diffuse knowledge, and is not to make methods and the best ideas of the leading and most successful manufacturers the common possession of all the members, to compile statistics, to promote goodfellowship and mutual confidence, to interchange views, and experiences and opinions, to assist in the formation of efficient local associations, to give spinal rigidity to the members and to teach in every possible way the important lesson that the laws of business are as stern and inexorable as the laws of the physical world. I am not inclined to assign a limit to the good that may be accomplished by this organization, when its educational policy shall have done its perfect work; but those who demand that, under present conditions, it shall determine the selling price of goods, are like those visionary and impracticable people, who, in yearning for the unattainable, do not see nor grasp the things within their reach. It may provoke a smile in some quarters to say the stove manufacturers are willing in meetings to frankly divulge and explain their business ideas and methods. Yet I believe the statement to be strictly true. It is not to the interest of any stove manufacturer that has competitors to conduct business without profit. On the contrary, no competitor is so bad as the competitor who is conducting his business at a loss. In these trying times no stove manufacturer can make money unless he manages his business on lines of sound business policy.

"Therefore, those manufacturers who are able at the close of the year to survey their inventories without chagrin and terror are only too glad to give their erring brother any information and advice which may assist the latter, and also to come through with the balance on the right side.

"The evils of competition are not due to an excess of knowledge, but rather to an insufficiency thereof. The most successful stove manufacturers are always those who are most willing to confer with their competitors, and to impart and ask for information in regard to business policies and methods. A stove manufacturer is not injured, but benefited, by the operation of his successful competitor. It is the unsuccessful competitor who is a menace and an injury. Many stove manufacturers who criticise the National Association of Stove Manufacturers seem to think that an organization of this kind ought to accomplish wonderful results without toil and effort, and that it should be an automatic, perpetual motion organization, which, once started, would continue to serve the purpose of its members and to confer great benefits upon them without work or attention on their part. As a matter of fact, the different members of the association usually receive benefits from it fairly commensurate with the work they do for it, and with the attention they devote to it. That nothing really valuable is obtained without work applies to this organization, as it does to everything else in this life.

"Stove manufacturers are prone to deplore the strenuous competition and the dwindling profits of the industry as being peculiar to this business, but this, it seems to me, is an error. The economic forces that have operated to reduce the profits in this business have reduced them in all others which are not hedged about by monopoly of some sort. Profits cannot be higher than the general average for any length of time, in any particular business. For a business that earns more than the average profit will quickly and surely attract capital to such an extent that its earnings will very soon be reduced to the general level. The troubles from which we are suffering are common, in some form or other, to every business in which men strive to earn a livelihood.

"To each stove manufacturer there seems as though there was an over-production of stoves. The business, it seems to him would be in a more healthful condition, if there were fewer stoves produced; but this, of course, applies to all stove foundries except his own. It is held, indeed, by many that one of the greatest barriers to prosperi-

ty is general over-production in all departments of industry. Now, special over-production tends speedily to correct itself by reducing the profits in the particular wherein it occurs, thus causing the withdrawal from the business of capital and persons, or what is equivalent, by preventing capital and persons from entering it. Special over-production, furthermore, tends to correct itself by increasing demand for all other goods. For a special over-production of certain goods enables the people to secure a given quantity of such goods in exchange for a less amount of their commodities or services than would otherwise be required, and they are thus enabled to demand more of the other things that gratify their desires. It is, of course, natural for those engaged in a business to desire the supply of the kind of goods they are producing to be limited. Our system of tariff protection has its origin in that desire, but it must be apparent to whoever will think that the largest possible production of all commodities cannot, if the other economic forces are in an approximately correct equilibrium, militate against the prosperity of the whole country. To consider otherwise is to suppose that we will have abundance and plenty because production is limited.

The Pewabic Founders.

(By Telegraph.)

The regular monthly meeting of the Pewabic Founders was held last Friday evening at the Grand Central Hotel, Pewabic. The president, Pumice De Witt, occupied the chair. The following were present: Pumice De Witt, De Witt Sausage Machine Co., Pewabic; Asbestos B. Hellso, Hellso & Holdon, Paradise Flat; Flux McFadden, Coon Hollow; Pasty Groesbeck, Bungtown; Tubal C. Klaiwash, Bulldozer Co., Paradise Flat; Jones De Fluor Spar, B. U. M., M. E., A. Malgam, The Twister & Scooper Co., Pokedelphia; Heab Mudtucker, Red Bluff Engine Works, Red Bluff; Prof. Hink Hokum, Squan Creek; Maj. Mathias Pocahannis, the Skinner Co., Skinapolis; Col. Phineas Snort, East Squakit; Alick Whackdem, Whackdem Iron Works, Pewabic; Wayback Gulliver, Piper's Gulch Mfg. Co., Piper's Gulch; John Gaggerless, Bungtown Agricultural and Bedspring Co., Bungtown; D. Oxite Bosphorus, Bulldozer Co., Paradise Flat; Dr. Salamander Pierce, C. I. M. D.; Scrappy Pinocle, Pinocle Foundry & Machine Co., Pewabic; Sublime Cannon, the Rainbow Chaser Co., Pumpkinville; Denny Beeswax, Prudence Skinflint and Constant Humpon, all of Pewabic.

The name of G. W. Sassafrass, the well known foundryman of Hamtramack, was presented for membership in the Associ'ation, and Secretary Hellso announced that he had been elected unanimously, without a dissenting vote, although no vote was taken. By way of explanation the secretary said that the times were too exciting to permit of subjecting new members to a rigid physical examination. The Pewabic Founders had yet to announce the backsliding of the first member, after once having his name recorded with a saturated solution of plumbago, although Prudence Skinflint had threatened to resign unless the dues were reduced to 60 cents per annum and made payable quarterly.

The following topical question was discussed: Is it economical to feed a molder on smoke, or should the same be removed, if it could be done for nothing. What has been your experience?

Mr. Mudtucker: The most economical way to remove smoke from a foundry is to let the molders condense it through their lungs. While it is true that it has been found a paying investment to install ventilators in blacksmith shops and other places where the atmosphere is a great deal purer than that found in the foundry, yet circumstances alter cases. Molders are tough and would live too long if their lungs were kept clear of obstructions and the fog removed from the shop. It is much cheaper to open a window or two and let the smoke and steam go out that way, if it is so inclined, though this should be done only in case of emergency.

Col. Phineas Snort: The smoke should undoubtedly be removed from the foundry, but whether it is economical to do so I am not prepared to say, as I have no statistics to support me.

Wayback Gulliver: There is no reason why a collection of statistics should be made before such a question can be discussed. Common sense ought to tell any man that a workingman no matter where placed, is going to do the best when his surroundings are such as to leave him in a comfortable condition. If a man is subjected to extreme temperatures or to the annoying effects of smoke and steam as found in most foundries he is worth less to his employer than if normal conditions prevailed. Too many em-

ployers labor under the erroneous idea that the heating and ventilation of shops is done solely for the benefit of their employes, when, as a matter of fact, it is done for their own good.

Major Mathias Pocahannis read the paper of the evening "The Effect of Metalloids on the Foundryman's Pocketbook." It is as follows:

"While conducting extensive experiments to determine the effect of metalloids upon the customers of the Skinner Co. at Skinapolis, a combination of nocturnal investigation and general credulity of man enabled me to discover that eighty-nine out of a hundred have an abnormal inclination to make steel castings without establishing a steel foundry. Show them a small test bar, having a diameter of 0.547 inch and a tensile strength of 15,000 pounds and then calculate what th's strength would amount to per square yard, and the average foundryman is ready to believe that he can lift himself by his bootstraps.

"The Pocahannis Semi-Steel Process is a metallurgical revelation of the first water. By buying a high silicon iron, which is weak and high in price, and adding steel scraps to same, its tensile strength increases at a remarkable rate, not known since Joseph Smith went to sleep and awoke with the Mormon bible. Of course by buying an iron lower in silicon at a lower price, increased tensile strength might also be obtained, but then it could not be said to have been reached through the Pocahannis process and castings that are honored with a regular anti-American name are worth several more dollars a ton than those which have not been so baptized."

Constant Humpon said this was the greatest paper that had ever been presented before the Pewabic Association, and he made a motion that each member be furnished with a printed copy with a request to sleep on same until the next meeting.

Heab Mudtucker said that the Association only had one major, and as great men were liable to drop off at any time, he favored the appointment of a committee to hold the major while a plaster cast was taken of his features.

The De Ditt Sausage Machine Co. were awarded the contract for reproducing the major, with instructions to plug up his ears and nose before beginning operations, in order that a mold might be made without any drawbacks.

Secretary Hellso was given liberty to charter a special car for the members to the Cincinnati convention. Same will leave Pewabic Monday, June 6, at 1:15 p. m.

The Effect of War Upon Business.

At the last meeting of the Philadelphia Foundrymen's Association Mr. C. P. Warner spoke as follows on this subject:

The effect of war on business at first will be depressing, but as it assumes a more earnest and definite form it will help it, especially so in all lines pertaining to army and navy supplies. It will also advance prices and values. All the wars of this country have terminated successfully, their effect was invariably beneficial to all its industrial, commercial and financial interests. The country after the Revolutionary war enjoyed a wonderful degree of prosperity for a period of over twenty years; indeed, unprecedented in the world's history. The war of 1812 had a like effect upon its conclusion, and with a war or higher protective tariff gave the country renewed prosperity up to the panic of 1819. The Mexican war in 1846 proved also of great benefit, coming at a time, too, when there was great discontent and suffering, prolonged after the panic of 1837. The result of that war, however, and with the discovery of gold in California and large acquisitions of territory, gave the country prosperity until the panic of 1857. The war of the Rebellion of 1861 had a bad effect upon all industrials, except what was needed in that line by the government, until the latter part of 1862, when business revived generally and kept on improving until the restoration of peace. After that we had good and very prosperous times until the panic of 1873. The enduring feature of that continued prosperity was mainly due to a high protective tariff, and which again carried the country out of and over the panic of the '70's, and gave it another period of great prosperity during the '80's, and up to the panic of '93.

The advantages of a protective, or high tariff, will be absent in the present contingency, because it has lost its former prestige, or no longer protects as it did then, and we are face to face in competition with the world. The good effect of this war, after its termination, will be a more perfect union of all our people, probably less politics and more patriotism, the expenditure of large sums of money on the navy, the establishment of a merchant marine, a still larger and

larger foreign trade, and the realization of the fact that we are not only one of the greatest nations upon land, but also upon the seas; the restoration of complete confidence in the unity and conscious greatness of our people, and the bringing to them of plenty and prosperity for years to come.

CORRESPONDENCE.

LET US HEAR FROM PEOPLE WHO KNOW.

Editor THE FOUNDRY:—We have been considering making a trial of a process which we believe is more or less in use, which consists of melting a certain proportion of steel or wrought iron, such as boiler plate, clippings, etc., in an ordinary cupola with pig iron, to secure a metal stronger and tougher than cast iron, having some of the properties of cast steel. Can you give us any information as to the proper proportions of the charge of this kind for a small cupola, say 23 in. or 27 in.; what kind of pig iron, clippings and other metal, if any, should be used, and their proper proportions?

SMITH & CO.

ANOTHER VIEW OF IT.

Editor THE FOUNDRY:—In the Review of Foundry Literature of the Month in February, 1898, issue of Journal of American Foundrymen's Association, an article entitled "Clean Iron Castings" attracted my attention mainly on account of the valuable complete analyses of a series of test pieces which are given to show the value of a "flux" called "Ferro-Sodium." To me these analyses merely prove what I constantly use in practice: the effect that certain kinds of minute changes of chemical composition will certainly produce though certain other larger changes can be made intentionally without any great effect on strength and hardness or even on all qualities in medium sections. The writer of that article does not seem to be aware that by causing these minute variations by a very different set of changes on the cupola charge a cost of 20 cents per ton for the ferro-sodium may be avoided and the closest economy of buying and mixing of metal practiced in a way to insure certainty at short notice in the production of a great range of work at one foundry.

Though the following analyses of the sample experimented with at A. Whitney & Sons' Car Wheel Works in 1895 are rather rough, they tend to confirm the belief that the fluxing action of soda ash has been used in some way to cause a cheap fluid pig iron to partially absorb and enclose steel and cast borings and chips which make the mass cool before all the slag made has come to the top. The slag and iron all sells together at a pretty figure, and as long as foundrymen will make their mixtures too rich, expensive and dirty because they do not closely apply chemistry they can be induced to buy such material to attain the required (and to them inappreciable) changes of composition:

Ferro-Sodium Metal.	Per cent.	Slag with it.	Per cent.
Iron	92.981	Iron	36.207
Carbon	2.968	Sodium carbonate	48.132
Silicon	1.668	Silica	7.640
Manganese	.553	Lime	.286
Phosphorus	1.190	Manganese	.894
Sodium carbonate	.300	Phosphorus	.528
		*Sulphur	.751
Total	99.790	Total	94.438

*As sulphates.

There are frequently cases where it is desirable to change a small amount of iron in a ladle to a particular character, but where there are several cupolas running different characters of metal surprisingly good and accurate results may be attained by mixing weighed or measured amounts of one or more molten irons together. But to do this with the greatest economy and certainty each mixture must be accurately figured and daily or regular simple physical tests compared with the chemical account of all the elements. In the July, 1897, issue of THE FOUNDRY, Mr. Keep referred to what I had written about this method of regulating mixtures and by cutting out in italics all the vital part of it which he refers to as "imaginary processes" he made it apparently describe his so-called "Mechanical Analysis" for silicon.

I have a large amount of graphical tabulation on the effects of minute variations which were compiled by Mr. Wm. R. Webster, C. E., from complete analyzed test bars from daily work of several months. The results are yet to be expanded by just such complete analyses as are so inexplicable to the users of ferro-sodium, rule of thumb, etc., but are explanatory, under my system, of the contradictory opinions regarding manganese, the strengthening effect of phosphorus in certain cases, etc. If this sort of cupola work were generally believed it would be found too expensive to depend on any alloy or grades of iron and grading by analysis would not be so difficult a matter.

ASA W. WHITNEY.

Chilling Iron.

It is generally accepted that the effect of chilling on an iron susceptible of being chilled, is to reduce its tensile or transverse strength, and at the same time increase its ability to resist compression. The chill is produced by such rapid coooling that the carbon, which is combined with the iron when the latter is in a molten condition, remains in the combined form. Chilled iron will withstand pressures much over 100,000 pounds to the square inch. To compress chilled iron a given amount requires more pressure than to compress the same iron, if not chilled, to a like amount. The modulus of elasticity is higher when the iron has been chilled. Following is a summary of compression tests made at the Watertown Arsenal on castings made alternately in sand and in a chill mold. The bars were circular in cross section and all had a gauged length of 10″. The chilled bars were chilled pretty uniformly on the cylindrical surface. The figures under the heading "chill" refer to the depth of the chill. The area is the sectional area. E refers to the modulus of elasticity. "Strength" is the ultimate strength per square inch:

	Area	Chill	E	Strength
Sand	4.909	....	17,073,000	111,020
Chilled	4.753	0.10	19,337,000	127,290
Sand	3.142	....	17,767,000	102,650
Chilled	3.017	0.15	19,886,000	138,910
Sand	1.779	....	17,861,000	90,050
Chilled	1.72	0.15	20,468,000	133,310
Sand	0.797	....	17,857,000	70,360
Chilled	0.77	0.25	21,875,000	126,750

It seems to be generally held that the chill, in a chill roll, for example, weakens the casting on account of its comparatively small tensile strength. In a roll the pressure of the metal which is being rolled produces a tension on the opposite side of the roll. It is asserted that the chilled part of the roll is much less able to resist this tension than the gray portion, and that it is liable to yield before the ultimate strength of the gray portion is reached. It is sometimes deduced from this that chill rolls should be made of as inelastic a mixture as possible, in order to reduce the liability to put the chill in a state of tension. That this theory requires more backing than has yet been adduced for it is shown by the result of an experiment on a portion of a chill roll, which was given in these columns some time ago. The experiment showed that the gray portion of the roll was in a state of tension, and conversely, that the chill was in a state of compression. When such a roll is made to do active duty, the gray iron opposite the metal being rolled will be put in a state of greater tension. This increase may amount to a very great deal before the chill is even relieved of its compression, and when this point is passed, and the chill passes into a state of tension, the gray iron will always be in a state of much greater tension. It does not seem, therefore, that in a roll such as the experiment referred to was made on, the chill weakened the roll by being less able to resist tension. That it may have weakened the roll in another way is not denied, but before intelligent steps can be taken to so produce chill rolls that the chill will not make the roll weaker than a similar one without a chill, it is of the highest importance to fully understand the exact bearing which the chill has on the strength of the roll.—Tin and Terne.

How it Looks in Figures.

The use of malleable iron castings about a car, to replace iron parts, has of late very materially increased. This has come about by reason of two causes. First, the desire to lighten the weight of cars, and to fit them with castings of stronger design and neater appearance, and second, the steady lowering of price of malleable castings, which has made it possible to gratify these desires. Some months ago we referred to an example of the extent to which malleable castings were coming into use, citing a modern 60,000-pound car, in which 83 per cent of the small castings were in malleable. This sort of work is now becoming more common. We may say in a general way that the weights of castings are less in malleable than in gray iron by from 25 to 60 per cent. Relative prices of the two metals are so now that the slight excess cost per pound of malleable over gray iron castings is met or more than met by the reduced weights of the material employed, and the resultant net costs may be said generally to be level, although in many cases the malleable has the best of it. A correspondent asks for detailed comparisons of weights of car castings, and we have taken pains to collate the figures for about a score of such parts. The figures we append:

	Weight, Gray Iron.	Weight, Mall. Iron.
Body side bearing.....	45	25
Body bolster filler.....	75	40
Bolster column	35	20
Draft timber keys.....	7½	3½
Brake head	22	11
Brake beam end casting....	4½	2½
Brake beam strut.....	7½	4½
Brake wheel	20	11
Body center plate.....	60	30
Brake ratchet wheel.....	7	4¾
4¼ x 8 in. journal box.....	98	60
4¼ x 8 in. jo'rn'l box wedge	10½	7
Truss rod corner iron.....	2	1½
Truss rod washer.....	10	5
Truss rod saddle.....	7½	4
Truss rod queen post.....	21	12
Truck end casting.....	100	50
Bottom side bearing.....	25	10
Draft lugs	25	12

On washers, braces and post shoes, and other smaller castings the reduction in weight is about 50 per cent.—Railway Master Mechanic.

Foundry Appliances.*

By S. H. STUPAKOFF.

Foundrymen, as a rule, pay close attention to the general outfit of their foundries. They are careful in the selection and in the construction of their cupolas, their blowers or fans, their core ovens and cranes. Taking into consideration the various purposes for which different foundries are fitted, whether for casting heavy or light machinery, stoves, hardware, pipe, rolls, malleable iron, steel or bronze, each has its peculiar arrangements, and each may vary considerably from others in its details; yet the general rule of equipment is followed by all. Of course, every foundryman knows there is considerable difference between the cupola of a gray iron foundry, the reverberatory furnace of the malleable foundry, and the open-hearth furnace of the steel foundry, as well as that of a brass foundry; but excepting these latter, which properly belong in a class of themselves, the gray iron foundry equipments very much resemble each other. Likewise the supplies are very much the same, though each specialty has its peculiarly adapted sands, facings, etc. But there exists a wide range of divergency in the foundry appliances, which are to be separately grouped from the fixtures and the supplies.

Conveyances for the raw material are mostly limited to the elevator for pig iron and coke. In some instances an elevated track is provided which furnishes the material at a level with the charging floor, while in most cases, mechanically, electrically or hydraulically operated elevators are made use of for this purpose. Comparatively few foundries are equipped with sand conveyors; though, where introduced and where intelligently manipulated they effect a considerable saving in labor. Conveyances for handling the molten metal are usually a traveling or swinging crane, or both, and generally foundries making only heavy castings enjoy the benefits derived from the use of either one of these. Small foundries, or those equipped for light or medium light work, have the metal carried by hand to its destination.

The next important things for the foundryman are his flasks. These may be divided into wooden and iron flasks, and again into ordinary and snap flasks.

Adding to the equipment mentioned above the cleaning barrel and core oven, we have a full outfit of an ordinary old-fashioned foundry, which would be ready to make and furnish castings for the market. But it is questionable if such a foundry could hold its own in our days of advancement, if it would compete with current market prices and leave a margin for its owner. Labor runs the cost of castings up, and the saving of labor brings it down. He who can save most in the production will profit most in his transactions. But labor can be performed either manually or by mechanical devices or by both means. Judicious selection, introduction and application of labor-saving machines is the only solution of the problem of competing with others and drawing dividends from an investment.

The modern foundry includes in its equipment sand conveyors, molding machines, sand mixers, follow boards, machines for cutting off sinking heads and gates, sand blasts, chipping tools, emery wheels, and a fully equipped chemical and physical laboratory. These appliances are of a great variety of construction, the maker of each one claiming special advantages over the products of

*From a paper read before the Pittsburg Foundrymen's Association.

his competitor. A great number of them are constructed to meet special requirements; most are adapted for special purposes, while few can be used for a general run of work within certain ranges, and hardly any advantage is offered to the jobbing foundry. In view of this, we may ask the questions: Has this ground been fully canvassed? Have all improvements been made which can be made? Must we stick to our old fashion? Cannot we simplify present methods? Cannot we reduce our present expenses and where could a saving be effected?

Let us take a walk through the foundry and see. We can naturally discover the faults of others and make comments on their shortcomings, though we may not be able to do better. Entering the yard, we happen to see a carload of pig iron unloading. There are five or six laborers at work, each one doing his share to hand out the pigs from the car, which others carry to the pile. This is slow work, costly and unsatisfactory. Right here we have room for improvement. There are certainly means to do this cheaper and easier; and if there are none, such means certainly can be provided. One would think that a simple overhead track, conveniently arranged with relation to the rails on the ground, and equipped with a hydraulic, pneumatic or electric hoist, which is especially adapted to the purpose, would replace all men but one to do the work quickly and cheaply.

Passing on, we see another gang unload a carload of molding sand; others wheel it into the foundry. Coke and sharp sand is handled in a like manner. No attempt is made, apparently, to save in the number of employes. They are certainly all old hands, and they must be supplied with some kind of a job. This is very considerate, indeed, but surely it is not very profitable. Why not get the sand in hopper cars, unload it with the aid of scoops and transport it from its bins by a suitable conveyor to its destination? Why not provide similar modern labor saving appliances for handling the coke and delivering this as well as the pig iron upon the charging platform? There is certainly too much time, too much labor and too much money wasted before the materials have reached their place in the foundry. An army of men is employed, which can be dispensed with by judiciously selecting and introducing mechanical appliances to take their places.

We take a few steps further and lose our way in a labyrinth of flasks, justly thinking that the poor fellow who has to hunt for a few of a particular size must lose his courage at the beginning. Of course, they have accumulated for years. They are too valuable to be destroyed; they may be called for at any time, and even if a board or two are eventually rotten and have to be replaced, it seems to be gratifying to live under the conviction that the right size may be on hand if an odd job turns up unexpectedly. Does not the space required for their storage seem to be a waste of room, which might be made use of for a better purpose? Does it not appear as if, in such a quantity of flasks, a great amount of money is invested, which pays very little dividends? Is this really a necessary evil, for which we have no remedy? Apparently this question has not received proper attention from the foundry manager. It may be possible to devise some means to avoid the accumulation of such dead stock, and, if this is accomplished, it is also possible to reduce the room for its storage.

I have constructed an improved flask, which, by means of a simple arrangement, I will be able to change into flasks of twenty different sizes, in less time than it would ordinarily take to hunt for a flask of the required size.

Quite recently I had made a dozen sets of these flasks, which, when assembled, represent seventy-two full flasks, though they replace in fact 240 flasks of twenty different sizes. I have therefore reduced this particular flask pile exactly 66 2-3 per cent. I mention this matter merely to demonstrate one way of overcoming an apparently necessary evil, which may be an incentive to follow the matter up and lead to further improvements.

Now, let us step into the foundry itself, and see if we could suggest there any improvements. It is really well equipped. It has good cupolas, an electric traveling crane, sand riddles, sand and loam mixers, several good molding machines adapted to special, always recurring work, sand conveyors and other appliances which are only found in the modern foundry. Each of these seems to suit its purpose admirably, and each has been carefully selected from among the best on the market. We dare not criticise. None

but intelligent workmen, who are fully acquainted with all the details of these machines, may be able to call our attention to some of their weak points—points, however, which may be profitably examined. Trifling improvements of factory appliances which suggest themselves during their service prove always of advantage to the manufacturer. The observing foundry manager, seeing his machines daily at work, will discover the shortcomings without his attention being called to them; and the progressive one, if he is not an engineer himself, will consult a mechanical engineer with the object of bringing his plant up to perfection. In some instances almost marvelous results have been obtained in molding with the aid of molding machines. The output of the foundry has been increased, and skilled men have been replaced by common labor. But so far there has not been constructed a really serviceable machine for a variety of articles as they occur daily in the jobbing foundry. Odd castings will always be molded by hand. Only where large quantities of the same article are required again and again is it profitable to apply patterns to a molding machine. And then the main feature in such machines will always be the withdrawing of the pattern from the sand. The ramming of the flasks will have to be done in most instances partly by hand, though in some cases it may be admissible to accomplish this with the machine. The shape of the pattern will determine whether one or the other of these methods is preferable. The easiest and cheapest way to prepare patterns for the production of quantities with the aid of molding machines or drawboards is to secure them to plates, which are fitted accurately to their flasks. Each case, however, will require some ingenuity if satisfactory results are to be obtained. Molding machines in general are good labor-saving appliances in the foundry; they increase the output, but do not entirely dispense with the service of manual help. It is not likely that we will ever reach the point of building entirely automatic molding machines which can be kept on a run of the same kind of a casting, without the aid of human agency.

A modern foundry, with or without molding machines, is not complete unless it is equipped with a good system of sand conveyors. They deliver the molding sand automatically to the place where used. They dispense with the wheelbarrow, and, to a great extent, with the shovel. A great variety of these appliances are in daily use, all giving saisfaction. In selecting a conveyor for a new plant, preference should be given to a device in which all moving parts subject to wear and tear by friction, are removed as far as possible from the sand itself. Hinges made of flexible material, such as leather or rubber, serving as connections for elevator sockets, scoops or trays, give excellent satisfaction and are in all cases preferable to metallic pin butt connections. What has been said about the delivery and distribution of molding sand is likewise applicable to the removal of burnt sand from the foundry. Labor is reduced in both instances, and the conveyor is an economical, reliable and untiring help in the foundry. Conveyors for the transportation of flasks, empty or molded, or molded and cast, are used in rare instances only. We have an excellent arrangement of this kind in our immediate neighborhood in the foundry of the Westinghouse Air Brake Works, at Wilmerding, Pa., which has been described in all periodicals paying attention to subjects of this nature; and I do not doubt that every member of the Pittsburg Foundrymen's Association had the pleasure of being entertained by Mr. Sleeth and was given the opportunity of seeing the conveyor at work at the model plant he superintends. I will therefore not make the attempt of giving here again a detailed description of its workings and of its construction. However, I will assert that the introduction of this or a similar system is equally advantageous, applied in all foundries producing castings in quantities within certain limits of weight.

This embraces about all that can be said in a general way about the present application of conveyors in foundries. To my knowledge nothing successful has been used, so far, to convey the molten metal from the cupola to various parts of the foundry, unless a crane or hoist is employed for handliag the large stock ladles. This, however, does not solve the problem. Ladles holding more than 100 pounds are carried as before, by two or more men from the cupola to the flask, and here we have certainly room for improvement. When pouring off time comes the foundry is generally short of hands, and everybody in and around it is compelled to pitch in. This deficiency induced

me to devise some means whereby each molder can handle his fluid metal without the aid of others, and I am just about ready to give it a test in the foundry forming part of the works where I am engaged. It will give me much pleasure to report to you at some future opportunity how successful I have been in solving this problem. There is no doubt that if the scheme works, as I imagine it will, I will be able to reduce the cost of our castings considerably.

We will now once more go back to the subject of flasks, which I mentioned above. Much valuable time is consumed in their selection, their preparation, and in their transportation to and from the foundry. And I am of the opinion that in each of these operations great savings can be effected by introducing and following some well worked out system.

Pneumatic hoists liberally distributed throughout a foundry will prove valuable savers of time for transporting, lifting, reversing, turning and closing the flasks, for transporting and setting heavy cores, and for lifting and removing the castings from the foundry floor. The introduction of pneumatic hoists in a foundry furnishes another valuable accessory to the molder in placing at his disposal compressed air, which not only replaces his hand bellows for ordinary practice, but is also an easy means of cleaning patterns and stripping plates of molding machines.

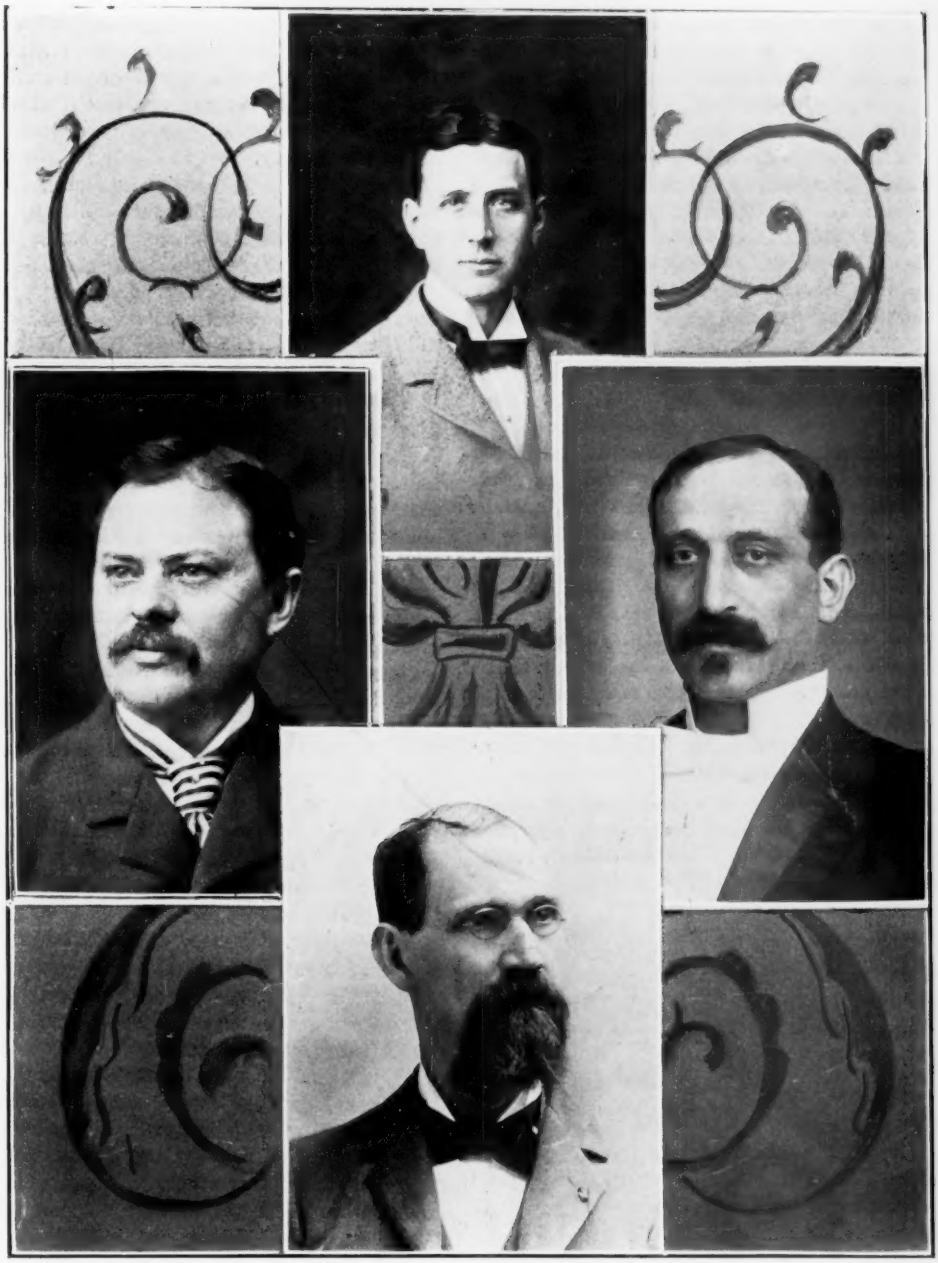
The clamping of the flasks enters as another factor of cost in the production of castings, which to my mind is an unnecessary expense. Means should be devised to clamp the flasks more quickly than at present, and, at the same time, at least as effectually as with the old fashioned clamps and wedges. There are several kinds of improved screw and lever clamps in the market, any one of which is superior to the old hook and wedge clamp. It takes a molder ordinarily half an hour to clamp up his flasks for a day's heat, which time is partly lost in hunting for and selecting the right kind. A serviceable clamp, forming part of a flask, which could not be lost and would always be ready for use, would be the ideal thing in the hands of the molder.

Cleaning barrels, which are known by some as rumblers, by others as tumbling barrels or rattlers, are in extensive use in nearly all foundries. They should always be provided with exhaust pipes to carry off the dust and burnt sand removed from the surface of the castings. They should be placed on a good foundation and protected by an outside shield or covering. They are always better outside the foundry than within. Many foundries rely upon the cleaning to improve the appearance of their castings by "running them through the mill." Rumbling, however, will not in all cases remove the molding or core sand sufficiently for tooling. Especially where castings are faced off or worked out with expensive milling or complicated boring tools, it is advisable to put them through a pickling bath. Diluted sulphuric acid, which was used until quite recently for this purpose, has been replaced of late by hydro-fluoric acid, which gives unquestionably better service. It is best to keep it in a lead-lined tank or box which is provided inside with strong wooden lattice work. Neither wood, lead nor iron is appreciably attacked by the acid, while it actually dissolves the sand adhering to the castings. The wooden lattice work protects the lead from injury and allows the sediment to drop below the false bottom of the bath. But a casting is not finished after it leaves the tumbling barrel. Gates and pins have to be chipped off to make a presentable piece of work. Sinking heads and gates of large castings are mostly cut off by circular saws, while hammer and chisel usually do the rest.

We have seen what extensive use we can make of compressed air in the foundry. And right here we have another application by replacing the ordinary hammer and chisel with pneumatic chipping tools. They accomplish about three or four times the amount of work which one man turns out in the old-fashioned manner. Though outrageously high-priced instruments, they will soon pay for themselves. The buyer apparently has to divide his profits effected by saving in labor, with the patentee or maker, or perhaps with both. These tools could unquestionably be made and sold for nearly one-third of the price for which they are sold at present; and if lower in price they would not only sell in larger quantities, but they would certainly be more universally introduced in all foundries.

A further valuable application of compressed air could be made by the installation of sand blast machinery for cleaning castings. I have personally never seen one of these sand blast machines in use in a foundry, but I have seen them used successfully

SOME PROMINENT OHIOANS WHO ARE WORKING HARD TO MAKE THE VISIT OF AMERICAN FOUNDRYMEN TO CINCINNATI A LASTING SUCCESS.



JAMES A. GREEN,
Treasurer General Committee of Arrangements.

D. B. MEACHAM,
Chairman Entertainment Committee.

LAZARD KAHN,
Chairman Reception Committee.

J. W. FOLEY,
Chairman Finance Committee.

in glass factories, and the results obtained therefrom convince me that they are equally as good for cleaning castings.

Sand mixers constructed after the principle of centrifugal machines apparently give the best satisfaction. In selecting the right kind, attention should be paid to the minor details of construction. Its bearings should be well protected, so that no sand or dust can locate between the rotating parts and their journals. The pulleys or driving mechanism should be conveniently arranged to suit each special case. A few years ago the writer met with some difficulties of this nature. A centrifugal sand mixer was purchased and had to be erected. The only main shaft in the foundry was the one which transmitted power to the blower for the cupola and to an elevator. It was a continuation of the main shaft of the adjoining machine shop, which portion was kept running from morning till night, but the part in the foundry was kept running only when the blast or the elevator was required. Besides this, there was no convenient place for the mixer in the immediate neighborhood of the main shaft. Therefore a small rotary engine was coupled to the upper end of the central shaft of the mixer. Steam pipes were led to and from the same and ever since it has worked admirably, never giving the least dissatisfaction. It stands isolated from the other machinery, at considerable distance from the nearest main shafting, and can be operated independently from other machines, whenever its service is required.

Not Enough of it.

You ask if we have any suggestions to offer, which will improve your paper if adopted. We would respectfully suggest that your paper is too valuable to be issued but once a month.

THE OHIO SAND CO.

Practice Makes Perfect.

Mr. E. H. Putnam comes pretty near hitting the nail on the head when he says in a recent issue of "The Tradesman" that "perfection is not accomplished by any one man; it is the product of the ages. What we as foundrymen seek to do is to produce castings as nearly perfect as possible within a limit as to cost. System is the most potent factor in the achievement of this result. The more restricted the variety of work required of the mechanic, the better will be his product. In these days of fierce competition, quantity is a word that must never be lost sight of. The first thing is a sufficient quantity of good, merchantable castings. Then, without abating the quantity, the quality must be worked up to the highest possible mark; and when this point is reached the hard work is only just begun, for any abatement of vigilance will be followed by a corresponding decline in quality.

I will dismiss the general jobbing foundry from consideration in this article by the remark that highly-skilled workmen and good facilities are indispensable here.

But the great majority of foundries are engaged in duplicate work. Here the workmen have greatly less general skill but much greater particular skill. It is important in this kind of work that the performer be confined to as few patterns as possible—if to a single one, all the better, for it is obvious that a man can learn to do one thing better than two or more. And it is certain that an apprentice can learn to mold a single piece in a few weeks under proper conditions better, quantity and quality both considered, than the first-rate mechanic can do at the outset.

I say "under proper conditions." This is a part of the statement that must not be lost sight of. I insist upon this very strongly, because, strange as it may seem, there are many foundries where it is entirely ignored. They see castings that were made in some distant foundry, and looking upon them with admiration, they insist that "we must equal this product." But they fail; they don't know why. They strive with all their might, but meet with never ending discouragement and defeat. You can't expect to win the race in cowhide boots. The factory where the good castings come from use Albany sand or its equivalent, while "we" use the cheapest stuff procurable in our vicinity. "They" spend a large amount of time and money in perfecting patterns that "we" would think thrown away; and "we" think this way simply because we are not sufficiently impressed with the fact that a perfect casting cannot be made from an imperfect pattern. And when I speak of perfect patterns I do not mean simply patterns with smooth surfaces and correct draught, for, while this might be sufficient with some patterns, yet it is far short of what is necessary. Take, for illustration a pattern weighing, say four ounces. It would

be very difficult to get a perfect pattern of this, especially if of such shape as to require "rapping" before "drawing," because the tools employed are too heavy, nay, the workman's hand is too heavy to properly manipulate so light a pattern. But when such patterns are gated in sufficient number to a correctly proportioned runner the whole card will have sufficient weight and size to enable the workman to manage it with ease.

In foundries where the highest grade of castings are produced all facilities are brought up to the highest point of excellence and they are thus mantained. In these foundries a foreman's suggestion of an improved facility is gladly welcomed and forthwith produced. But there are many shops where the foreman hardly dares ask to have a broken pattern repaired; and yet his employer wonders why his castings are no better. Perhaps the greatest obstacle to advancement in many foundries is the fact that the ingenuity of the foreman and his men will enable them to produce tolerable castings with the most execrable facilities."

CAST IRON NOTES.

Devoted to Inquiries from Practical Foundrymen on the subject of Melting and using Cast Iron. Address all Inquiries to W. J. KEEP, care of The Foundry.

CHEMICAL ANALYSIS OF PIG IRON.

The attention of founders seem to be taken up with the war with Spain, for very few questions have come in regarding foundry matters since the issue of THE FOUNDRY for May.

I had a talk to-day with a man, which brought out many interesting points.

The irons under consideration were Southern. I claimed that a No. 2 foundry iron should contain at least 2.25 per cent of silicon, a No. 1 soft iron 3.00 per cent and a No. 2 soft nearly as much. That less silicon than that would lower the grade and should be sold for a less price. That we must have the silicon, or we did not want the iron. I know of a case where a No. 2 Southern pig iron contained only 1.25 per cent and another which was sold for a No. 2 soft contained but 1.25 per cent of silicon.

The conversation at once drifted to the question whether with the rapid running, Southern furnaces could make pig iron with the silicon anywhere near what it used to be, and the opinion was that low silicon was to be the rule, and that the necessary amount must be added by softeners containing from 5 to 7 per cent of silicon.

The only way to compel the furnaces to make iron that will contain the silicon that they are represented to contain is for the founder to have analyses made of the irons that he receives.

Some irons will make castings with a skin so hard that it is about impossible to cut it, and yet the casting under the skin is exceptionally soft, and increasing the silicon sometimes increases this surface hardness. The only help is to find the iron that causes the trouble and use so little that this peculiar influence cannot be felt.

When silicon is spoken of as the controlling element, it is taken for granted that the other elements are what are expected in good iron. The fast running of modern furnaces produces pig iron with low carbon as well as with low silicon. Such iron is not at all suitable for a foundry iron.

It would be very satisfying if we could without materially adding to the cost know the chemical composition of the iron we use.

Lately we have heard much about chemists using uniform methods. This is very desirable; but as applied to cast iron, the variation in results due to analytical methods is very small, when compared with the variation in the composition of the iron itself. Pig iron is not a chemical compound, but an imperfect mixture of quite a number of metals and metalloids, which have different freezing points and different weights. In solidifying, some parts are fluid and run out from among other parts and when cold there is a great lack of homogenity.

Drillings from a hole, or from a large number of holes, may not represent those that could be taken from other parts. Unless the one who obtains the drillings is an expert he will allow sand to be mixed with them. An analysis from drillings free from sand will give a close approximation of the chemical composition of the iron from which the drillings were taken.

It hardly seems as though the chemists, or their present methods, were to be complained of in analysis of cast iron.

However much the melted iron is mixed after being taken from the furnace, in the distribution to the ordinary pig bed, and more especially during the solidifying of the iron, the location of the different elements in the mass will be so very irregular that

drillings will never give more than a close approximation. There should be no sand allowed to get in, because the method of taking out selected grains with a magnet will not pick up the non-magnetic particles. It is not certain that the bits of iron cut out by the drill, and which the magnet picks up, contain as much of the non-magnetic elements as the dust and graphitic flakes which have fallen out of the spaces between the grains.

Cast iron will always be a heterogeneous mixture, and a chemical analysis will always be an approximation of its composition.

But this is close enough to use in making mixtures in foundry practice. The lack of uniformity in cast iron analyses does not necessarily result from inaccuracy of the chemist or of his methods, but from the uneven character of the pig iron.

In steel, which is vastly more homogeneous than cast iron, the determum of various chemists vary very little.

Output and Comfort.

That molders as well as other mechanics are able to turn out more work is permitted to assume a natural position, ought to be evident, yet much is sacrificed in this respect to certain traditional policies. The idea that a molder should break his back in stooping over work is one of these, and the following lines written by Thos. F. Kennedy for "The Metal Worker" touches the question in a commendable manner:

"Can any one name a single body of workers in any field of human activity who stoop to do work when it can be avoided except molders? I could fill this page with a list of trades and arts where there is better reason for stooping to do the work than there is in molding small stove work, and yet means have been found to avoid it. How many molders does the reader know who are suffering from lame backs brought on by stooping?

"It is a fact that all molders will testify to that small work, no matter how arranged, is much harder on the back than large work. It is a common thing to hear a molder say, 'I don't mind the large work, but the small work is killing.' And there are plenty of molders who can do a good day's work on large work who could not stand to take small pieces on the floor, though the large work requires far more exertion than the other. A molder making small pieces on the floor must maintain a stooping posture of varying degrees all the time while molding, excepting the short time while ramming, and all don't straighten up then. The molding time varies from six and a half to eight hours. A man of average height must work more than one-half of this time bent over to an angle of 90 degrees, and I have seen men making work which required great care in finishing who had weak sight, or, having strong sight in poor light, bent over at an angle of 50 or 60 degrees doing the most particular part of their work. Did the reader ever notice the small percentage of old and elderly men engaged in stove molding—smaller than in any other occupation of which I have any knowledge? There are plenty of molders shortening their lives working on small stove work on the floor who have recurrent attacks of lame back and sore chest. These often become chronic, and they are obliged to give up. A very large percentage of these defects would never develop sufficiently to cause inconvenience under normal conditions where a man could stand up straight, or nearly so, all the time.

No wonder statistics collected a few years ago showed that the average length of time spent at the trade by those learning it was fifteen years. The first impulse of a young man or boy when he starts to learn the molding trade is to avoid stooping by kneeling down, but the foreman or instructor will quickly tell him that he will never make a molder if he kneels down to any of his work. Jobbing and machinery molders do kneel sometimes, but I know of but one stove foundry where it is a common practice, and there the follow boards are very poor. It is related of the workers in an industry where the large quantities of dust and fumes were a constant menace to health that when a device was invented which promised to nullify their evil effects its use was secretly opposed by the workers on the ground that its introduction and successful use would surely cause a reduction in wages. No doubt this consideration would produce and nourish a hostile sentiment which would cause plenty of floor molders to stand in their own light, and deter them, if they were allowed to choose, from taking advantage of an improvement even though it promised to lessen their ills and lengthen their days.

"In following out the rule laid down for follow boarding I would eliminate wherever practicable the portion that says one kind of pattern and make it simply one pattern on each board. Any piece which from its size and nature cannot be made in a snap flask, and is too small to be made one in a flask on the floor, will, in nineteen out of every twenty cases, make a good job if made alone on a board in a suitable flask on a properly designed movable bench. It is to be anticipated that objections would be made to any such radical departure from long-settled practice. Most of the objections are obvious to the experienced stove man. The molders would, no doubt, for reasons already touched upon, offer numerous trivial objections. The only one I can think of worthy serious consideration is the raising of the sand an additional fifteen or twenty inches and the lifting of the finished mold from bench to floor.

"I claim that being able to stand erect 99 per cent of the time trebly compensates for the extra exertion involved in raising the sand and lifting the mold."

The Recovery of Iron From Cupola Cinder.*

By W. J. KEEP.

COST OF PRODUCING STOVE CASTINGS MUST BE REDUCED.

Under the present conditions the cost of production of stove castings must be reduced or it will be necessary to show very small profits in the future. If wages are not to be decreased, methods must be adopted which will require a less number of men to produce the same number of castings, and waste or material must be reduced. The Michigan Stove Company are introducing labor saving appliances at every point, and are lessening waste, that they may be able to leave wages as they are.

RECOVERY OF IRON FROM CUPOLA CINDERS.

I have been requested to give our experience in recovering iron from cupola cinder. Few founders realize the loss of iron which finds its way to the dump in the form of small shot. The small shot that is spilled from the ladles is not saved by the coarse riddle used in screening the scrapings from the gangway, and each ton of dirt that falls under an ordinary cinder mill contains from 200 to 400 pounds of fine shot. The skulls from ladles contain 75 pounds of iron for each 100 ladles.

*Paper read before the National Association of Stove Manufacturers at Philadelphia.

SHOT IRON WILL MAKE SOFT CASTINGS.

There is a prejudice that shot iron will not make soft castings. That is a mistake, especially with the small shot that is taken from the cupola. It is our custom to charge all iron recovered from the cinder mill on top of the first charge of iron. The larger pieces descend with the rest of the charge, while the smaller shot rattle down onto the cupola bottom. The first iron that covers the bottom melts this fine shot. I do not intend to cover the whole subject, but to confine myself to cupolas melting with coke.

THE ORDINARY CINDER MILL.

For years we have used two mills with an inside diameter of 26 inches, and 48 inches long. The cast staves fit closely at the edges and have holes 3-16 by 1¼ inches cored through them and set at an angle of 45 degrees. In use, these openings become wedged full of shot, so that it would seem that hardly anything could get through. If the openings remained open, an enormous quantity of iron would escape. On account of the holes being clogged, the iron that is recovered is mixed with small pieces of slag and coke that have not been broken fine enough to fall out of the mill. Where 60 tons of iron are melted, there will be returned with the recovered iron, one ton of slag, which clogs the cupolas. It requires two mills to mill the cinder for a 60-ton melt, and it takes the time of one man to tend them. One day I washed a portion of the dirt from under one of these mills and estimated that we were losing 480 pounds of iron each day.

THE WATER MILL.

To prevent this waste, we ordered one of these mills from W. W. Sly, of Cleveland, Ohio. The cylinder is 30 inches in diameter and 40 inches long, and has on the side a water-tight door. A ¾-inch stream of water enters a perforated head on the left end and leaves through a peculiarly constructed separator in the right-hand end, the entrance and escape being through hollow trunions. The mill is filled with four or five wheelbarrow loads of cinder, which is broken by a crusher weighing about 400 pounds, and a load of cinder can be added every 15 or 20 minutes. The recovered iron is not re-

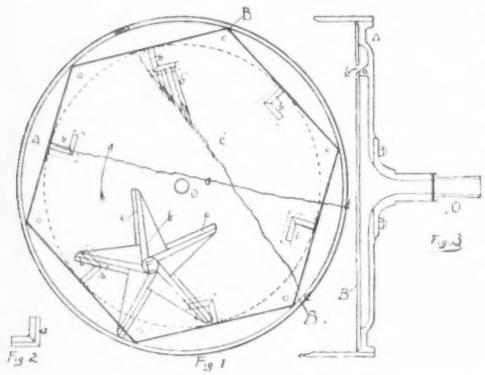
moved until 800 or 900 pounds have accumulated in the mill.

INSIDE OF SEPARATOR HEAD.

The sketch (Fig. 1) shows the inside of the separator head. A is the cast head; B is a hexagon steel plate fitted into a recess so that the face is level; bb are L-shaped slots or ports cut into the hexagon plate B, through which dirt and cinder pass into the space C; aa are ledges cast on the head, and correspond in size and shape with the ports in the steel plate. Their inner edges are sloped to form an inclined plane directly under the ports in the steel plate. This is shown in Figs. 2 and 3. In Fig. 1 is shown the crusher (E), which consists of two cast ends (f), to which are riveted steel plates ¾" by 6" and nearly as long as the mill.

OPERATION OF THE MILL.

The operation of the mill consists in grinding the cinders and washing the dirt away much as gold is washed. For this purpose



a waste pipe is attached to the left hollow journal. The mill is filled with cinder, so that when the mill starts the water will keep the separator clear. The mill revolving in the direction indicated by the arrow brings the ports bottom up on the descending side of the mill, and as the water and cinder lines will lie in different planes, as shown by c and d, Fig. 1, the water line d being nearly horizontal, the ports will pass from d to c through water holding in suspension the finer and lighter material which has been separated by agitation, and which will rush into the port as it passes beneath the water line d, Fig. 1. If iron enters the chamber, its gravity will carry it to the bottom of the chamber and it will be caught by the buckets formed by the L-shaped ledges under the ports and carried on the ascending side of the barrel above the cinder line c, Fig. 1, where it drops down into the barrel, as shown at b. The water carries the dirt, slag and coke out through the hollow journal and spout O into a wheelbarrow. The water mill delivers clear iron. One mill does more than the two old mills, and allows the attendant to use one-quarter of his time on other work.

The scraping from the gangways, the skulls from ladles and any refuse containing iron can be run through this mill.

SAVING BY THIS METHOD.

It costs about $1 per ton of recovered iron to run the mill, and to be on the safe side I have estimated that the recovered iron is worth $6 per ton. I take this low value because there is an opinion that shot iron is not as good as larger scrap, and because a small portion may be lost, and also because I have not taken into account power and several minor expenses.

The data from which the conclusions of this paper are drawn, were obtained by taking the cinder from our two cupolas in which was melted 59 tons 900 pounds of iron, and which produced 8,280 pounds of cinder, after all pieces of iron and coke that could be picked out had been removed. This cinder was broken fine and thoroughly mixed and divided into two equal parts, one of which was run through an old mill and the other half was run through a water mill. The weights are doubled to represent results of the whole 8,280 pounds through each mill.

ORDINARY MILL TEST.

There was recovered 4,984 pounds of iron mixed with small pieces of slag and coke, and 3,296 pounds of dirt and lost iron was taken from under the mill. I passed the 4,984 pounds of iron and slag through the water mill and recovered 2,590 pounds of clear iron.

WATER MILL TEST.

From 8,280 pounds of cinder there was recovered 2,928 pounds of clear iron. The difference in favor of the water mill was 338 pounds, at $6 per ton, a saving of $1 each day. One water mill does the work of the two old mills. Each old mill cost $100. The water mill will cost $250.

AN EXTRA CASE.

Take an extra case, no mill; melt of ten tons each day; cupola cinders not milled, but thrown away. This is not an imaginary case but of common occurrence. This foundry is

located near our works and we cart the cinder and run it through our water mill.

The cinder averages 1,400 pounds for a ten-ton melt. An ordinary mill would be worth $1.28 each day. It would take seventy-eight days to pay $100 for an ordinary mill, and during the remainder of the first year of 200 days an additional $156 would be saved, and each year thereafter $256 would be saved. With a water mill the 1,400 pounds of cinder yields 480 pounds of clear iron, worth $1.44 per day. A water mill at $250 would be paid for in 173 days, and save $39 during the first year and save $288 per year afterward. The difference in investment is $150 and the saving is $32, which is 20 per cent on the difference in cost.

ANOTHER CASE.

Take another case; a ten-ton cupola already equipped with an ordinary cinder mill. Would it pay to throw away the mill and put in a water mill? The $32 saved is 12 per cent of $250, the cost of the water mill.

SAVING OF WATER MILL.

I take it for granted that a foundry melting thirty tons will have an ordinary mill. A water mill would save $96 per year, or 38 per cent of the cost, certainly a good investment. For a sixty-ton melt, the saving is 76 per cent on the investment. The saving would be $1 per day, which would pay for the mill in one year and two months, and each year afterward the saving would be $200. There is also a saving of 30 cents per day in addition to this, because the attendant gives one-quarter of his time to other work. There is also one ton less slag charged into the cupola to clog it. My experience differs somewhat from others; some have saved more iron. I have given actual figures from one day's work.

I have not taken into account the cost of setting the mill. We located it on a sloping concrete floor, where the water flows into a settling box, measuring four feet each way inside, and then to the sewer. The waste water from our nickel room is used in the mill.

There should be an allowance made from the savings shown for power, repairs, cost of water and cost of setting up mill.

It Helps.

THE FOUNDRY is to us "Meat, Drink and Raiment," and we look forward each month to its day of appearance.

T. B. HARKINGS FDY. CO.

Bristol, Pa.

The Making of Matches.

To facilitate rapid work, especially in small castings, a match or follow-board of some kind becomes essential. The nature of the work, and ability to handle the different materials used for making matches will determine what particular match is the most suitable. Mr. Thos. F. Kennedy recently contributed a couple of papers to the "Metal Worker" on oil and plaster of paris matches, which we reproduce, as we believe them of interest to every active shop worker.

MIXING THE MATERIAL FOR AN OIL MATCH.

Get a bottom board free from holes with an area of about six square feet, say 2x3 feet. For the purpose of measuring the material lay the frame on the bottom board, and as the sand constitutes the bulk of the material it is all that need be measured. By noting carefully the irregularities in the drag one can come very close to the right amount, whether more or less than the frame level full. Any kind of well burned molding sand will do, but I find that the best of all is sand from castings that have been cleaned with a wire brush; no mill dust. Put this through a very fine sieve, not less than No. 12, the fine sifting being essential to the making of a durable match. If too coarse a sieve is used the edges of the match exposed to wear will soon crumble, and these matches have often been condemned for not wearing well when the fact was they were not properly made. If raw linseed oil is to be used, mix with the sand about 1 of litharge to 16 in bulk of sand. No rule as to exact proportion of oil and sand can be given, but a quart will wet from 140 to 180 cubic inches of sand, enough for a frame 10x14 to 12x15 inches 1 inch deep, or 1 of oil to from 7 to 10 of sand in bulk. The only rule I observe is to make the sand as wet with oil as possible without danger of it sticking to the pattern. This is another reason why these matches do not wear well; not enough oil is used in them. Mix the oil and sand thoroughly, as much of the wearing qualities of the match depend on it. Get an old ¼-inch riddle, as it would spoil a good one, and work the mixture through it with the hand. Never try to shake it through, as the driest part would go through first, leaving all the wet lumps till the last, and thus interfere with the mixing.

If a good quality of boiled linseed oil is used no litharge or other drier is required,

unless one is in a great hurry for the match, when a little added to the oil, about 1 ounce to a quart, will cause it to dry more rapidly. Too rapid drying, however, is to be avoided. Throw a little parting sand on the drag, put on the frame, pass the straight edge along it to see that all high points clear, and see also that it is level, so that when the bottom board is nailed on it will not draw. If the flask is good and straight the frame may be leveled down to it by springing it; if not, it should be leveled up with skewers of wood or a little sand. Riddle a layer of the prepared sand into the frame now as you would on a cope, having placed the drag with the frame on alongside the bottom board on the floor so as to waste as little sand as possible. Fill the frame and give all the corners and pockets an extra tuck with the handle of the hammer, pean around the inside of the frame as you would a cope and butt it all over lightly but often; strike it off level and throw a little sand on loosely, as on a drag. Give the bottom board a few hard rubs to get it solid, put a small nail through the board into the frame near each corner, and if match is a shallow one it will be well after giving the board a rub to give it a coat of oil. Replace without rubbing and nail it on.

Screws are nearly always used to secure the bottom to the frame, and for a long time I used them, but find that it is unnecessary labor, as the nails answer the purpose. Roll it over now so as to bring the drag uppermost. Be very careful doing this, as the least shock may spoil it. A mold of ashes would be stable compared with an oil match at this stage. Lift off the drag and clean off all molding sand. Get a handful of the prepared sand, take a small trowel or slick, and go over all high points, such as at the toe of a stove leg or at the hinges of a door, as these are apt to be soft and must be made hard. Build a little of the sand on and press it down until hard enough. All sharp edges of the parting where the pattern will strike when being worked in and out should be examined, and if found treated the same. Get some small nails or brads and push them into the sand, two or three to the inch, at high points where there is a sharp edge and along all sharp edges. Rap and draw the pattern now. If you want a real nice looking job and a match that can be varnished without absorbing all the varnish, slick it all over. This is a tedious job, as it must be done with a small tool, but a molder who takes any pride in his work will not let it go out of his hands until he does it. Take an old sponge now and drop some oil on all high points and around all sharp edges with which the pattern will come in contact. If the sand does not appear to be wet enough drop oil out of the sponge all over it. Take the slick again and touch up any spot that dropping the oil may have made rough, and set your match to dry. Put it in any safe place where there is a good current of air to dry. Rats will destroy it while soft, and the least shock or anything falling on it is fatal to it. If in a hurry for the match put it on top of the boiler or core oven, or any place where it is hot, but not hot enough to scorch wood, and it will dry in a few hours. If not in a hurry it should be left over night, and it will be dry enough to use next morning. Get some nails long enough to go nearly through the bottom board when driven through the frame, and drive them through the frame into the board about four inches apart all around. Drive from a half dozen to half a hundred, as many seem necessary, through the face of the match into the bottom board. If the match is a very deep one there is no need of driving nails through the frame into the board; drive them into the face of the match first, then turn it over and drive a few through the bottom board into the frame.

This method of making matches is now widely known and practiced in a way, but the philosophy of it is but little understood. I have often asked men who could make a good one of these matches, "What makes them hard?" but not even one had the least idea or sought the reason. I remember well a man who worked in the shop where I started as an apprentice, and who made some oil matches. He kept the ingredients and mode of mixing jealously secret, and always retired to a corner of the warehouse, where no one could see him, to prepare it. Coming out he looked as mysterious and solemn as an oriental magician. If any rash apprentice asked a question about it he would shake his head ominously, as much as to say, "Better without such knowledge, my boy."

Still to any one familiar with the chemistry of oils there is no mystery about it. Writers on the chemistry of oils divide them into two great classes, volatile or essential oils

and fixed or fatty; these latter are again divided into drying and non-drying. Many of the liquid fixed oils thicken on exposure to the air, and under favorable conditions dry up, leaving only a resin or gum, which is at first sticky and later plastic. The oils possessing this property are termed drying oils. Drying oils when finely divided have a tendency to inflame spontaneously, caused by a chemical action which chemists call oxidation. Raw linseed oil has great drying qualities, which are considerably enhanced by boiling. During the latter operation driers or promoters of oxidation are added, such as red lead, manganese or litharge. The proportions and mode of mixing these are kept secret, but it is known that they act as carriers of oxygen.

The most rapidly oxidizable drying oil is boiled linseed, and in using it for a match no additional drier is required. It is not advisable to hurry the process too much, as it seems to leave the match brittle. A chemist would advise when using litharge to dissolve it in the oil, and no doubt you would get quicker action, as it is on the oil it acts, but it is more convenient to mix it with sand, and I have never had any trouble using it that way when I used raw oil. The agent that binds the atoms of sand together and makes the match hard, tough and slightly elastic is, of course, the gum contained in the oil, hence the necessity for thorough mixing and bringing every grain of sand into contact with the oil, also the necessity for sufficient oil.

It is noted elsewhere that drying oils finely divided have a tendency to inflame spontaneously, and if mixed with any inflammable substance, such as waste, under favorable conditions fire results. The conditions under which a match dries are most favorable except that the sand is non-combustible and otherwise neutral, so that the heat generated only aids in the oxidization, and drives off all moisture and volatile matter, leaving nothing but the sand and gum. When too rapid drying or oxidization takes place, too great a heat is generated, which destroys the strength of the gum and leaves the match brittle, so that it crumbles easily.

In concluding about the oil match I will add that it may be set down as an axiom, the more oil the harder, and the longer to dry. Remember to put the sand through a fine sieve. This covers all points, and any molder who reads this ought to be able to make an oil match.

THE PLASTER MATCH.

Prepare the drag the same as for any other match. Draw the pattern or patterns, and with a sponge or piece of waste give it or them a coat of some heavy oil; common lubricating oil will do. Be sure not to leave any spot, especially along the edge, uncovered, as plaster of paris adheres to bare iron, and when the pattern was drawn it would spoil the match. Plaster of paris, when mixed with its own bulk of water, forms a sticky paste which almost immediately becomes solid. Some qualities of plaster of paris absorb more water than others, and the quantity of water with which the best result may be obtained can only be found by experimenting with a handful of plaster. Different substances have been recommended from time to time as improving the wearing qualities when mixed with the plaster, especially iron fillings. I have used the latter, however, but could not see that it made any perceptible difference. I do know, though, from actual experience, that the hardest and strongest matches are made with the least water. Of course, enough water must be used so that the mixture will be sufficiently plastic to take good impressions and fill all sharp edges and corners.

For very light matches the bottom board may be put on the frame and a hole made in it three or four inches square, according to the size of the match. Drive a few nails in it from the inside, allowing the heads to project so they will come close to the face of the match when the frame is on, and have them long enough to go through the bottom board and clinch them on the outside. These will hold plaster better than if driven into the side of the frame, as is often done, even when the frame is deep enough to allow of a good groove being made around the inside. This is a wise precaution, and takes but a few minutes. In preparing to pour this kind of a plaster match, the mixture must be thin enough to run to the furthest corners and fill them. The joint between the drag and frame must be carefully stopped with clay or banked with sand to prevent the mixture running out. Build an inch of clay all around the pouring hole to give it a head, put some weights on the battens of the board, and it is ready to pour. Pour it quickly; don't dribble it. When full, and at

intervals until it is settled, rap the frame gently with the hammer, which will agitate the plaster so as to assist any air to escape, and allow the plaster to settle homogeneously. It will shrink a little as it hardens, and it is well to have a little extra to pour in the head in case it gets too low. As soon as it is hard enough to move with safety, turn it over and lift off the drag; then clean off the sand so you can get at the pattern, and draw it out. Take the match to the water tank or hydrant, or pump, and wash off all sand; take the slick or trowel, and if the parting is high at any point it can be scraped off until right. Put the match now in the sun, or where there is a good current of air, and in an hour or so it will be ready for a coat of shellac varnish. When this is dry it is ready for use. A good quality of this varnish is a great protection to a plaster match, and as soon as it shows signs of wear should be renewed.

Another way to make these matches is not to put any bottom board on the frame at all, but nail the battens direct to the frame, or put the bottom board on when the plaster is about settled. Less water is required by this method, hence stronger and harder matches can be obtained. Matches with less than an inch of plaster are difficult to make this way. Mix the plaster with just enough water to make it sufficiently plastic to give good impressions, and to run into sharp corners. Have a slight surplus of plaster mixed and tuck into the frame with the hands, leaving it the least shade higher than the frame. This done, get a piece of sheet steel or a sharp iron strike, and when the plaster is settled so it won't shrink any more, but is yet soft, pass the strike along the frame so as to bring the plaster flush with the frame, and then nail on the bottom board. It is always better to use a bottom board, as it gives support to the match, which the battens nailed to frame do not. When the board is nailed roll the match over, lift off the drag and scrape away most of the adhering sand, so you can get at the face of the match, and then drive nails through the frame and face of the match, the same as in an oil match. Small nails or brads may also be pushed into the plaster along sharp edges and places that are liable to prove weak. All the nailing must be done quickly before the plaster gets too hard. The patterns should be rapped loose the first thing after the match is rolled over, but not drawn till the nailing is done. Small nails or brads may be stuck in the plaster close to the pattern when the match is made by the other method, also if it appears to need them. When the nailing is done draw the pattern, wash, examine the parting, dry and varnish, the same as when made by the other method.

The objection to plaster matches is that the working in and out of the pattern soon wears off the most essential part of the match, the sharp edges, and this in spite of the nails. Plaster is lighter than sand, its specific gravity being about the same as wood. For this reason it has an advantage on large matches, which, if made of oil and sand, would be inconveniently heavy. As to which is cheaper, and easier to make, there is little choice, though the plaster is a little cheaper. I believe the oil match can be made quicker than one of plaster, and the plaster makes a great mess, no matter how careful one is. If it was nothing but cleaning the pattern after a plaster match, it is a disagreeable job. Matches when out of use are much better preserved by having the pattern on, and where patterns are not kept in a fire-proof vault, or otherwise especially provided for, this should be done. In case matches are stored without patterns they should never be piled one on top of another, but should be set on edge and allowed to lean lightly against each other. They will occupy just as little space this way as the other way. I know of a few oil matches that have been in use ten years, so that in point of durability there is no comparison between them and the plaster. If any reader of this article has had any experience that seems to conflict with any statement made herein I would be pleased to hear from him.

Western Foundrymen's Association.

At the last meeting the following officers were elected: President, G. H. Carver; vice-president, A. M. Thompson; secretary, B. M. Gardner; treasurer, O. T. Stantial.

The Cincinnati Convention of Foundrymen.

In addition to the various subjects of interest to be discussed at the convention at Cincinnati, June 7, 8, 9 and 10, as announced in our last issue, an address dealing with the Southern iron interests will be delivered by James Bowron, first vice-president of the Tennessee Coal, Iron and Railway Company.

and Mr. E. H. Putnam, one of the vice-presidents of the association, will contribute a paper, entitled, "Inspection of Castings."

One Way of Getting Along.

The Stowell Manufacturing & Foundry Company, of South Milwaukee, Wis., evidently desires to secure the co-operation of their employes, as the announcement made by them at the beginnig of the year, and printed below, will show. Nothing appeals so much to a workman as to be able to earn more money than his neighbors. It is true that profit-sharing has been tried before and failed, but this has largely been because it was sought to obtain workmen at a lower rate of wages on account of the benefit supposed to accure from the division of profits. In the end there was no gain to either party, which should have been expected, as human nature does not consider anything a gift which is simply taken from the workman's wages and repaid to him as profits on the business. True profit-sharing should be made with the object of increasing a man's earning power by increasing his efficiency through an active interest in his employer's affairs, which can only be done providing the workman receives an actual benefit. The Stowel Company says in their announcement:

"Believing that the interests of the employer and employe are too closely identified to succeed independently of each other, therefore this company has decided to offer to co-operate with its employes by allowing them to share in the earnings of thecompany for the year 1898.

"A year ago, when trade was dull and the situation demanded it, a reduction in your wages was made. You accepted the cut cheerfully under the circumstances, and we stated to you that when business proved more profitable we would give you the benefit of a share in it.

"We have adopted the following plan of co-operation. After setting aside a fair profit on the year's business and a reasonable rate of interest upon the capital invested, the surplus over and above this will be divided pro rata between the company and its employes, taking the capital stock of the company and the total amount of the pay roll and salaried employes combined, and dividing proportionately.

"Every employe is thus a member of the company, and if time is lost, material wasted, or the company defrauded in any way, it is just so much money proportionately out of your pockets, and there will be so much less to divide at the end of the year. Let us work diligently and energetically for the company's interests, each one striving to do more than his share, and the result, we hope, will not only solve the labor problem for us, but prove a happy and prosperous year for all concerned."

A Foreman's Qualities.

Molding, to most eyes, is seen only as a dirty trade, in which nothing but brawn and muscle are required, and the mechanic in his line is no better in the sight of the general public than the dirty-faced molder. Very few writers take iron and its different processes of manufacture as a subject, says "Ferro," in the Industrial World, probably owing to the fact that they who follow the foundry business and have a thorough practical knowledge of it, are not adapted to putting their thoughts upon paper. In the case of most foundrymen, they have not the time to devote to writing. We are, as a class, very selfish when compared with other trades. When a molder hits upon a new idea, he generally shows it to a few of his shop-mates for self-aggrandizement and there it ends. In other trades, when a mechanic runs across something new, there is generally some one who will generally get it into print, and it becomes a help to his fellow-craftsmen, wherever they may be.

The writer of this paper does not wish to be understood as trying to cover our entire trade in all its little details, which would be an inhaustible task, but with almost a lifetime spent in the foundry, part of the time as a master, he has run across many little things which might prove interesting and possibly instructive to others.

There are a great many suggestions in connection with foundry practice which should be taken separately and developed until all combined produce a perfect shop, which might be classified about as follows: Management, discipline, equipment, care of tools, etc., cupola, mixing of irons, the molder, sand used, coremaking, handling and cleaning, tests of iron, etc. The writer will treat upon the above subjects from time to time, and will be pleased to have others who are better versed in some of the classifications to give their's, that in the end we may serve the one purpose, viz.: to instruct.

The first requirement for a successful foundry foreman is that he should have a thorough knowledge of the class of work he is expected to produce, whether his iron is required to be very soft and open, or close and strong, for purposes which require strength, in preference to softness or close-grained, and soft as for fittings for hydraulic or steam purposes, which have to be threaded and tested, and how to produce them at different times when required. It is also essential that he should be able to keep up his mixtures some times when he has run out of some of the brands of iron necessary, until such time as he can replace them. To use the words of a well-known writer: "The master of the foundry must be master of the cupola." (West.) He should have a thorough knowledge of all the little details in handling the cupola, chipping out, lining, putting in breast, arranging sand bottom, mixing and charging; not that it is necessary for him to do the work, but he should be able to say to his men that he does not ask them to do things which he is unable to do himself.

He should have a thorough knowledge of the different brands of iron required and keep himself posted on the cost of the same, and if it were possible it would be advisable for him to acquire a knowledge of the different metalloids and their effects upon his mixtures.

Next, he should be thoroughly posted on the different grades of sand, their cost, and adaptability to the class of work he is to produce, and wherever possible, he should endeavor to cut off waste of the same. "A penny saved, is two pence earned."

He should be a student of human nature and have the confidence of his men. Molders are naturally of an independent nature, and very often serious troubles might be avoided by the use of a little common sense on the part of the foreman. Very often the molder is chided by the foreman for things which if they had consulted each other would never have happened.

Among the Foundries.

Leroy Willey will erect a foundry at Mt. Upton, N. Y.

The Culter & Proctor Stove Co., of Peoria, Ill., are erecting a new warehouse.

Warden King & Son, of Montreal, Canada, have increased their foundry by an addition of 150x40.

The Globe Foundry Co. has been incorporated at Miamisburg, Ohio, to carry on a general foundry business.

The Quincy Foundry & Novelty Co. has been incorporated at Quincy, Ill., by W. E. Williamson, S. C. Pitney and L. E. Emmons, Jr.

Shetter & Co., of New Cumberland, W. Va., have purchased the foundry hitherto operated by James Means & Co. at Steubenville, Ohio.

William S. Luckenback has purchased the George Foundry & Machine Works at Rome, Ga., and will make extensive improvements in same.

The St. Albans (Vt.) Foundry Co. has secured a contract to supply the Canadian Pacific Railway Co. with all the car wheels it requires for its service in the United States.

George B. Swope has purchased the foundry and machine shop at Washington C. H., Ohio, formerly operated by Jenny & Manning, and will continue the manufacture of bells, and general jobbing work.

Frank D. Runser, of Sharon, Pa., has purchased from Frank P. Hood the plant of the Pultney Foundry & Engineering Co., at Youngstown, Ohio. The works, which have been idle for the past three months, are now operating under the name of "Mahoning Foundry & Machine Co."

What a Little "Ad" Makes an Editor Say.

The Morrisville Foundry Co., of Morrisville, is composed of some of the go-ahead business men of that place. Their foundry is equipped with conveniences for doing all kinds of work in that line they are ever called upon to do, and is in the hands of men who understand their part of the business. The machine shop is furnished with everything needed for that rapidly growing part of the Co.'s business. Power is furnished by one of the latest improved Otto gasoline engines, perfect in its working. This part of the work is under the personal charge of Mr. C. B. Green, who is a thorough machinist, and as a draftsman and pattern-maker he ranks way up, being able to draft any machine, part, or model, make the pattern, and finish the work. If any one has anything to be done at a foundry or machine shop it will be well to write or telegraph them. See their ad. in another column.—Hardwick (Vt.) Gazette.

Tales of Woe.

The fate of the Walter A. Wood harvester works of St. Paul, seems to be sealed. Receiver Lindeke is out with a statement which shows that the big plant in which so much St. Paul capital was invested will soon be a thing of the past, only serving as an illustration of a false idea of business prosperity, of municipal greed and envious ambition. Minneapolis once had a very excellent harvester plant in South Minneapolis. St. Paul gobbled it for its projected Woods company; the thing was overboomed and the inevitable result followed.—Minneapolis Journal.

Tullahoma, Tenn., February 12.—A meeting of prominent business men was held last night to consider a proposition of Northern capitalists to locate a large foundry here. A representative of the capitalists was present and made a proposition to locate the plant here provided the people of Tullahoma would donate a building and lot. it was stated that the amount that would be paid to the employes would be $5,000 a month in the event the plant was located in this city.

T. J. Cornish agreed to donate two acres of land in East Tullahoma on which to locate the plant, and it will only take about $2,000 to erect the building which is required by the gentlemen who propose to operate the foundry. This is a small sum to be paid for such an important industry, and if other satisfactory inducements cannot be agreed upon, the chances are very favorable for it being raised.

About thirty of the representative citizens of Bucyrus, including merchants, manufacturers, and builders, met at the probate office Thursday evening in answer to the call to meet the representative and hear a proposition relative to locating of shops here for the manufacture of a class of iron goods. Briefly stated, his proposition is that in consideration of two acres of ground, with shops, and a 25-horse power boiler, he will immediately locate here with ample machinery for the manufacture of radiators, with a guarantee to work not less than forty men nine months in each year, with as many more as the exigencies require, and for a longer period in each year if that should be needful to meet the demand.—Bucyrus (O.) Telegraph.

By Way of Advertising.

The B. F. Sturtevant Co., of Boston, have issued a catalogue describing the large variety of steam engines made by them. A copy will be mailed free of charge upon application.

The Robertson Printing Co., of St. Louis, Mo., have issued a little booklet, compiled by J. E. Cartwright, entitled "Manganese in the Foundry," which describes in detail the effects of this element upon cast iron, according to the opinion of the most noted metallurgists.

The Ridgely & Johnson Tool Co., of Springfield, Ill., have issued an illustrated catalogue of the pneumatic tools made by them. They claim to have entirely overcome the shock and vibration commonly found in this kind of appliances, and that a man will do more work with their tools on account of the greater comfort and ease with which they may be operated.

The Lunkenheimer Company, of Cincinnati, Ohio, have issued an illustrated catalogue of the large variety of valves, injectors and steam specialties made by them. Perusing this book strictly from a foundry point of view one can not help but notice the innumerable complicated castings turned out by this company, the high grade of which has made the name of Lunkenheimer famous throughout the land.

The Chicago Retort & Fire Brick Co. of Chicago have issued an atlas containing many special maps of Cuba, Porto Rico, Spain, the Philippine Islands and other places wherein the people of this country are now especially interested. This is the kind of an advertisement that has some life to it, at least it will keep out of the waste basket until after our dispute with Spain is settled. Every time the atlas is referred to the investigator is bound to notice the product of the Chicago Retort & Fire Brick Co., and while we believe the greatest part of the money spent for individual advertising is wasted, we must acknowledge that providing this kind of advertising is placed and can be retained in the hands of those interested in this company's products, it should bring its publishers some good results. In advertising, as in everything else, it pays to get the best, and the Chicago Retort & Fire Brick Co. have certainly not stinted their appropriation for this purpose.

NOTICE!

Advertisements in this column, 30 cents a line for each insertion About seven words make a line. The Cash and Copy should be sent to reach us not later than the 20th to insure publication.

Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, we will give one free insertion under this heading to those in want of positions, the advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

WANTED—A second-hand cupola, capacity 3 tons per hour; also a second-hand fan or blower, No. 6 or 8. Address "Cupola," box 138, care THE FOUNRDY.

WANTED—Position by a foundry foreman accustomed to all kinds of dry, green and loam work; experienced in mixing iron and handling men; best of reference. Address, E. M., Box 136, care THE FOUNDRY.

WANTED—A foreman by a large Eastern foundry making heavy machinery castings of all characters. Only men with extended experience and the highest references need apply. Address, "EASTERN," Box 137, care THE FOUNDRY.

WANTED—Situation as brass foundry foreman. Have had twelve years' experience on both light and heavy castings and can come well recommended as to my ability in mixing metals and handling men. Address, "BRASS," Box 97, care THE FOUNDRY.

G. T. GLASCOCK & SON, GREENSBORO, N. C., have U. S. Patent on a Safety Andiron for wood. Very durable and ornamental. Will be glad to sell shop rights to foundrymen for making these Andirons. Can furnish patterns and electrotypes. Write for particulars.

A FOUNDRY CLERK, well versed in all the details of turning out work and for years connected with one of the largest foundries in America, desires to make a change. Will prove a valuable assistant to the foreman of any extensive foundry. Address "Foundry Clerk," Box 133, care THE FOUNDRY.

WANTED—Position as foundry foreman, or would lease a foundry, or run the foundry by the ton. At present employed by large manufacturing concern; have held position as foundry foreman in large shops for over 20 years' continuous service; competent to handle any class of work except stove plate. Highest references as to ability, sobriety and economy of management. Address W. H., Box 132, Care THE FOUNDRY.

A BARGAIN—Foundry blower with direct coupled engine. Baker rotary pressure blower, size No. 4½; manufactured by Wilbraham-Baker Blower Co., Philadelphia, Pa.; capacity 16½ cubic feet per revolution; inlet, 7 inches by 43 inches; outlet, 11½ diameter. Ames engine lively upright; size cylinder, 7 by 8; stem pipe, 1½; exhaust pipe, 1½; height, including engine, 6 ft., 10 in.; length, including engine, 8 ft., 4 in.; width, including engine, 3 ft., 4 in.; speed 150 to 275 revolutions. Blower has been used about six years for an hour to an hour and a half a day; has been thoroughly overhauled and is now in first-class condition, practically as good as new. The engine is new, never having been run except in testing. Price of complete outfit, f. o. b. cars Oswego, $350. Weight about 7,000 pounds. Address, AMES IRON WORKS, Oswego, N. Y.

Clay, which is one of the most useful portions of the earth's crust, is found nearly everywhere, but the pure form of it, having the highest refractory properties and burning a dead white color, is rare. When found, we call it kaolin, or china clay. Kaolin is found at Woodbridge, N. J., in South Carolina and other places, but still we import quantities of china clay from abroad, which does not seem quite right. The theoretical composition of clay has been stated by authorities to be 39.45 per cent of alumina, 46.64 of silica, and 13.91 of water, or in round numbers, alumina, 40; silica, 46; water, 14; but this absolutely pure clay is so rarely found in nature, and in such small quantities, as to be reckoned a mineralogical curiosity. The nearest approach to it that we have ever met with on a large scale is at Warrenton, Mo. On the ranch owned by Frank Reifsnider, of Akron, O., there is an immense bed, about 80 acres in extent, of practically pure kaolin. Analysis shows that it contains alumina, 41.48; silica, 43.56, and water, 14.05 per cent, while the total impurities, consisting of sespuioxide of iron, 0.35; lime, 0.45; magnesia, 0.08, and alkalis, 0.20 per cent, amount only to one per cent, which is found to have no appreciable effect, as goods made from it exhibit the highest degree of refractoriness. There will probably be a large demand for this exceptional clay.—Brick, Chicago.